GOVERNMENT OF INDIA

DEPARTMENT OF EDUCATION.

INDIAN EDUCATION

IN

1913-14.

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CONTENTS.

Introduction.

It has been felt that a brief annual narrative on educational progress in India will be a convenience to the growing number of those who are interested in the subject. This increase of interest and the more prominent place which education is rapidly assuming in the administrative problems of the country are sufficient excuse for the innovation. Hitherto it has been customary to place more important statistics and a short statement of noteworthy developments before the Imperial Legislative Council during the course of the debate on the budget. The time has now come for the publication of a narrative, which, while not pretending to be exhaustive, will serve to inform the reading public and to supplement the quinquennial reviews. The present report is based mainly upon the annual reports of the Directors of Public Instruction for 1913-14 and upon official correspondence.

Appended to the report are the general tables and some illustrations of new buildings completed during the year. These last are merely a selection from among many which have been erected, but will serve to give an idea of the activity which has prevailed.

INDIAN EDUCATION

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I.—Main features of the year.

1. The chief event in the history of Indian education during the past few years has been the allotment of large imperial grants. These may be recapitulated as follows :— *Imperial grants.*

	Non-recurring.	Recurring.
	₹	₹
1911	90,17,000	...
1912	65,00,000	60,00,000
1913	3,19,00,000	55,00,000
1914	...	9,00,000
TOTAL .	4,74,17,000	1,24,00,000
	£3,161,000	£826,000

The whole of the non-recurring grants was not made available during the year of allotment but was spread over periods of two or three years.

2. It is important to consider how far these grants have been expended. The table in the appendix shows, province by province, the amounts placed at the disposal of the provincial Governments over and above the expenditure in 1910-11, and the amounts expended. Inclusive of the unspent balances carried forward from previous years, the expenditure in 1913-14 might have been 850½ lakhs. The actual expenditure was only 550 lakhs. This presentment of the case is, however, misleading. In the first place, the large non-recurring grants given for education were not made available in their entirety in any one year, but were spread over two or three years. Thus, the large non-recurring allotment of ₹3,19,00,000 given in 1913-14 was to be made available over a period of three years. Hence, even supposing that full expenditure was possible in all provinces, the sum spent could not have exceeded about 650 lakhs (*i.e.*, some 200 lakhs less than the figure 850 lakhs given in the appendix), because approximately one-third only of the allotment was placed at the disposal of Local Governments. Secondly, certain sums were given for specific schemes which have not yet matured. Such sums are necessarily carried forward year by year in the provincial balances. *Their expenditure.*

Hence the total unspent balance at the close of 1913-14 was 300 lakhs, but that from budget allotments only 100 lakhs. The figures in the appendix

will correct themselves in the course of time as the full grants come to be included in the provincial budgets—though new distributions will be apt again to disturb the figures. The value of the appendix is that it permits of a ready comprehension of the general financial position with reference to both present and future additions to budgets arising from grants already made, and shows the balance for educational purposes which would ordinarily be available for any Local Government during the next few years. But it does not at present convey a correct idea of the position in any single year or of the balance available in the year immediately succeeding. This defect may be rectified (as has been roughly done above) by adding in annually, not the total amount allotted to education, but the amount of it annually made available for budgets. It was not possible to prepare the table in this way during the past year. Efforts to do so will be made in future.

Notwithstanding the circumstances just described, which make the unspent balance appear larger than it really is, the fact that the expenditure was something less than 100 lakhs below what it might have been is disappointing. The machinery in some provinces and administrations urgently needs strengthening. It is to be remembered that in 1910-11 the expenditure on education from public funds amounted only to 370½ lakhs. In 1913-14 the same source contributed over 550 lakhs towards the total disbursements on education. This increase in expenditure must have thrown a considerable strain upon the organisations directly concerned with the carrying through of schemes. In a complicated system of Government many wheels combine to the execution of any single project. The inability of one wheel impairs the action of all the rest.

That which it is necessary to guard against is the occurrence of any unnecessary delay in putting schemes into operation and the possible withdrawal to other objects of sums previously devoted to education. It is useless to replenish a granary if the lower sacks are pulled out while new ones are piled upon the top.

Boards and education.

There are some adverse comments on the expenditure of local bodies. The Madras report says that nearly 15 lakhs was given by government to boards and municipalities for their schools, whereas these authorities spent on them altogether 23 lakhs—a sum which the Director thinks does not compare favourably with the large subsidy. The Punjab report is still more emphatic; and in the resolution the Lieutenant-Governor regrets that many municipalities show no sign of increasing interest and realisation of their responsibility in the matter of education, and especially of primary education. "There are still," proceeds the resolution, "several instances of municipal schools being run at a profit, and it appears that in many cases a grant from government is not followed by increased educational expenditure, but is simply utilized to set free for non-educational purposes the sums hitherto spent on education by the committee. So long as this apathetic attitude is maintained, as the Director points out, educational grants to municipalities cannot achieve their object, and where such cases are brought to his notice the Director should have no hesitation in recommending the withdrawal of all or part of the government grant." The Assam report brings to notice the action of a certain local board which closed some forty of its schools thus involving a reduction, at a time when the board's educa-

tional allotments from the government were being largely increased, of no fewer than 801 children in the higher classes of vernacular schools in the sub-division. "It is useless," writes the Director, "to comment on the local understanding, so disclosed, of the principles of self-government. To what exigency the board thought it proper to sacrifice the education of the ryot I do not know; but action has been taken to secure that it shall be prevented in future from any such flagrancy of re-action."

General expenditure.

3. It will be convenient to add here that the total expenditure from all sources on education has amounted to ₹10,02,23,877 (£6,681,591-16-0) against ₹7,85,92,605 (£5,239,507) in 1911-12 and ₹9,06,13,595 (£6,040,906-6-8) in 1912-13.

General principles.

4. We have next to consider the objects for which the imperial grants were specially provided. In their resolution of the 21st February 1913, in which were laid down the guiding principles for educational policy and for the spending of these grants, the Government of India first of all emphasised certain points in respect of which the system in India, often criticised as bookish and unpractical, is thought to have failed or to have been reared on too narrow a basis. Formation of character was to be the main objective. The question of religious instruction presents difficulties, but the tendency has been to develop the intellectual at the expense of the moral and religious faculties. Accommodation in properly supervised hostels, attention to hygiene, the introduction of modern sides and practical instruction, the avoidance of cram by more rational systems of examination—these were among the more important reforms inculcated. In the different departments into which education falls, attention was called to the following matters. The number of universities was to be enlarged, teaching and residential universities were to be established, research was to be stimulated, the pay of teachers in secondary and primary schools was to be improved, and training facilities were to be increased. Larger grants were recommended for secondary aided schools. There was to be expansion of primary schools, mainly under board management. Technical and industrial education was to be developed along the most natural and fruitful lines. Oriental studies were to be encouraged. A more suitable scheme of education was to be provided for girls and imparted more fully through female agency. Muhammadan education was specially treated in a subsequent circular. The superior inspecting staff was to be strengthened. The aim of these pages is mainly to show what progress has been made towards the attainment of these objects. Some points will be dealt with in the sections to which they belong. The more general may be disposed of at once.

Moral and religious instruction.

5. As regards moral education, the Bombay Presidency has had the advantage of a visit from Mr. F. J. Gould, with whose recommendations the Government have generally concurred and have appointed a consultative committee to foster the growth of the movement. The report, however, does not appear to take an optimistic view of the subject and quotes the remark of one of the deputy inspectors that "the ill discipline in the homes of children will counterbalance any amount of instruction, or personal good examples in morals, received at school." "Thus," says the Director, "one set of people tell us that moral training is entirely an affair of the home and that it is un-

necessary for the school to meddle with it; while another set tell us that it is useless for the school to meddle with it, since any good done will be counteracted by the home." On the other hand, he emphasises the importance of boys' co-operative societies, of which a considerable number seem to exist, and other practical indirect methods of forming character. The teaching of morals has been continued in Burma. In government schools the instructor is a member of the staff; but a number of priests pay regular visits and deliver discourses—though in some cases their help is withheld because the customary offering is not forthcoming. Here again it is pointed out that home influence is the main factor and that " Burman parents do not realise their duties either towards the children or towards the school." The Punjab report strikes another note and emphasises the personal example of the teacher, which is often lacking because the narrowness of choice precludes selection. " A growing restlessness and disregard for authority, manifested by strikes and a tendency to change from school to school if promotion is refused or punishment inflicted," is attributed to the dearth of strong headmasters and weakness on the part of subordinates.

The committees which have met in the provinces for the discussion of moral and religious training differ in their opinions as to the efficacy and possibility of the latter. Some provinces have not yet reported. In other provinces there is the feeling that something must be done. Meantime the experiment continues in the United Provinces, where " religious education is imparted in all mission schools and in some government and aided schools " and where " opinions differ as to its results," and in Burma, where the school staff do what is possible with the aid of *pôngyis*. A subsidiary product is the breaking down of the barrier that existed between the lay school and the priest. In some of the government high schools, however, religious instruction either has not been attempted or has been abandoned because of the apathy of parents.

It is clear that the home and the teacher are of vital importance in this question. As improvements are made in the staff, the forces of indirect moral training will be brought to bear, and direct teaching will become of greater effect. The attitude of the parent is beyond the scope of administrative measures. School gatherings and periodical reports on pupils are measures which have been adopted and which may have effect. The materials are not yet available for any definite pronouncement on religious education.

6. In the last two years the number of hostels has risen by over a thousand and that of their inmates by 22,224. There are now 3,879 hostels with 129,607 boarders. Reports say little as to their effect and the method of their supervision.

hygiene. 7. The Government of India allotted R25,00,000 non-recurring and invited Local Governments to call committees and frame schemes for school and college hygiene and the physical welfare of pupils. The following reforms have been carried through. In *Madras* particular attention has been paid to physical training, and a post of instructor in this subject has been created for European schools. The Government of *Bombay* framed a scheme for medical inspection of school children. Five school doctors are to be appointed to examine boys in secondary schools when the financial situation admits of the expenditure involved. The scheme has

been sanctioned. Meanwhile, medical inspection has already been initiated in some schools. Weighing machines and eye charts have been provided in government institutions. It is satisfactory to find an unaided private school making a record of weights and measurements and furnishing parents with reports by a qualified dentist on the state of the boys' teeth. The Parsis show themselves specially careful regarding their children's health, and it is reported that they employ an honorary staff of thirty-five doctors including eight ladies for the medical examination of those who are in schools in Bombay city and that advice cards have been sent to parents in the case of 1,265 children. A class was held in Poona for the training of teachers in physical exercises, and a book was under preparation. Government is also utilising the education department in the campaign against tuberculosis by imparting lessons on hygiene and making liberal grants to any municipality desirous of establishing open air schools. Considerable strides are being made in this Presidency in the matter of school hygiene; and the Government is making use of the St. John Ambulance Association in carrying out its schemes. The committee assembled in *Bengal* to consider the subject has not yet reported. But some action has been taken. Three lecturers toured the province, delivering lectures on sanitation, illustrated by lantern slides, with special reference to the prevention and cure of malaria. A grant is given to the Young Men's Christian Association towards the salary of a physical director, whose services are utilised by the education department. The Government of *Bihar and Orissa* also utilised his services for the training of drill masters, and purchased several play-grounds and erected gymnasia at government high schools. Schemes have been received from *Burma* and *Assam*. In the *Central Provinces* ample provision has been made for playing grounds for all secondary schools. In the *North-West Frontier Province* two specially trained sub-assistant surgeons have for the present been appointed to undertake the inspection of boys in anglo-vernacular schools of two districts, their attention being specially directed to the eyesight of pupils and to the examination of buildings from a sanitary point of view. A special class has also been opened for instruction in hygiene of selected teachers of anglo-vernacular schools and a simple hygiene course has been included in the curriculum of the normal school for vernacular teachers.

8. The introduction of manual training is, quite apart from the cost, no easy matter in India. Nevertheless progress has been made. In Madras, two appointments of instructors in manual training have been created. In Bengal (where it is thought that its introduction " would go far to counteract some of the worst defects of secondary schools for Bengali boys ") it is hoped to select a few schools in each division for the introduction of instruction in woodwork. A class was held during the year for instructing the teachers of European schools in this subject. The teaching of manual training at the Allahabad Training College has been successful, and the report speaks of the creation of a new manual training block at one of the government high schools—from which it may be gathered that the subject has gained root in those institutions. Slöjd has been introduced in thirty-three Burmese schools, and nearly 2,000 pupils were trained in this form of work. *Manual training.*

Excursions. The Bombay report indicates the large use which has been made of excursions for pupils and teachers under training to places of interest.

School-leaving certificate. 9. As regards tests, in Madras 4,860 secondary school-leaving certificates were completed during the year. The number of candidates at the school-leaving certificate examination in the United Provinces has risen to 1,631. The requirements for recognition of schools for this examination are more exacting than those for the matriculation; principals of colleges find that students who have passed the former have a better working knowledge of English. The number of those taking the high school final examination in Burma, though still small, is rising.

Qualifications of teachers. 10. The chief defect in education in India still remains the slender qualifications of the teacher. Last year it was found that 62,675 teachers were trained out of a total of 229,140. This year the corresponding figures are 67,494 and 242,544. The percentage of those trained has thus risen from 27 to 28. Larger facilities are counterbalanced by heavier demands. The proportion of those trained among elementary and secondary teachers is now as follows :—

	Per cent.
Elementary teachers	24
Secondary teachers	32
Teachers in European schools	52

Strictly, the classification is of vernacular and of anglo-vernacular and classical teachers. These, however, answer roughly to elementary and secondary teachers. It is noteworthy that among the latter (in schools for Indians) only 6,762 possess degrees out of a total of 100,887.

Among recent developments in training may be mentioned the opening at Dacca of a nature-study class for vernacular teachers; the framing of a scheme for placing the *guru*-training schools of Bengal on an improved footing along the lines previously adopted in Eastern Bengal; the provision of special courses at the Allahabad Training College; the opening of a number of special elementary classes in Burma; and, in several provinces, a satisfactory increase of the numbers reading in middle vernacular schools, from which the material for vernacular teachers is largely drawn.

Salaries of teachers. 11. No efforts to increase the facilities for training, however, are likely to be effective unless backed up by such improvement in pay and prospects as will induce the right type of person to submit to training and to adopt teaching as a profession. The record of reform in this direction is the most important feature of the year. In *Madras* allowances have been added to the pay of trained and approved teachers of elementary schools under public management whose pay is less than R10 a month so as to raise their salary to R10, the grant of capitation allowances has been extended to trained teachers in schools containing standards higher than the third and an extension has been granted of the concession regarding pupils of backward classes. The scale of teaching grants to aided elementary schools has been modified so as to encourage the employment of trained teachers. Instead of a uniform rate of R36 a year for each teacher, the scale is now R48 or R42 for trained teachers of the higher and lower grade respectively, and is retained at R36

for untrained teachers. The rates of stipendiary grants for masters and mistresses of the secondary grade have been raised from ₹6 to ₹8 a month to ₹8 and ₹10. In secondary schools, more than 1½ lakh was distributed by way of grants and subsidies to improve the salaries of teachers. In the secondary schools of *Bombay* a scheme has been framed for fixing initial pay of graduate assistant teachers at ₹50 a month; supplementary grants have improved the pay of the teachers in aided schools, "but it cannot be said that the quality of the teachers has shown much improvement." A sum of 1½ lakh was given for the raising of the pay of trained teachers of primary schools; the total which has been given for this object now amounts to ₹6,33,690 recurring, exclusive of a further allotment for women teachers. A definite scale of staff has been kept in view in aiding secondary schools in *Bengal* and some improvement was effected by means of the imperial grant for aided schools. The salaries of trained elementary teachers were raised by ₹3 and those of untrained teachers by ₹1. The fact that this modest reform cost nearly 4½ lakhs during the year indicates the scale of operations and the costliness of even the most necessary reforms in this Presidency, where the average cost of a boys' lower primary school is still less than ₹102 a year. The elaborate scheme for reorganising secondary education in the *United Provinces*, including the improvement of the pay of the staff, was described in the sixth quinquennial review. The question of pay in primary schools has been dealt with by the committee which recently reported on the whole subject of elementary education. In the *Punjab*, a scheme for improving the pay in secondary schools had been previously sanctioned; we read that the increase "is helping to popularise the profession." The revised rates of aid have assisted managers in offering fairly adequate salaries to teachers in aided schools. As for primary teachers, "the minimum rates of ₹12 per mensem for an assistant and ₹15 for a head teacher are everywhere in force (in the Multan division the maximum pay is ₹30); progressive pay and personal allowances have been introduced in some districts: postal allowances of varying amounts are paid in many cases, and teachers are given the benefit of provident funds. As a result the teacher's calling has become popular, and there is no lack of candidates for admission to the normal schools and training classes." Particulars are not given in the report from *Burma*; but improvement is shown by the fact that the annual cost of a secondary school has increased by ₹631 and that of a primary school by ₹15. The Government of *Bihar and Orissa* have made a good beginning in the abolition of the unsatisfactory lower subordinate service, while elementary teachers have derived solid benefit from the imperial grants. In the *Central Provinces* the minimum salary of graduate teachers has been raised to ₹60, regular promotion on a time-scale secured, and a generous supply of special posts on higher pay for selected men provided. The minimum pay of under-graduate teachers has been raised to ₹40 and corresponding improvement has been made in higher grades. A pension scheme has been brought into force for primary teachers in district council schools on ₹11 and upwards and the pay of all certificated teachers has been raised to the pensionary level. The fixed pay (apart from capitation) of teachers in lower primary schools in *Assam* was raised from a minimum of ₹3 to a minimum of ₹8, and a number of schools were established upon a regular

scale of pay in which the three teachers draw ₹20, ₹12, and ₹10 respectively. The introduction of a uniform system of provident funds for District Board teachers was effected in the *North-West Frontier Province.*

12. The establishment of these provident or pensionary schemes was a feature of the year in some provinces and a further extension of the system is desirable in order to secure a contented and permanent body of teachers. It is important that some provision for old age should be made in the case not only of government and board servants but also of the great mass of those employed in privately managed institutions. The Government of India have long had under consideration a scheme of general application and a small committee examined the question during the year. The large scale on which any such scheme must be framed, the variety of conditions to be provided for and financial considerations have hitherto prevented the maturing of this proposal. Nor is the proposal unanimously supported by Local Governments. In the meantime, local schemes have to some extent taken shape. The provisions described at page 124 of the sixth quinquennial review apply mainly to board or municipal teachers: so do those mentioned above as now existing in the Punjab and the Central Provinces. In Madras some of the managers of aided schools have instituted their own provident funds: and, where the rules are approved by government, expenditure on this object is admitted in calculating grants. Provident funds in secondary schools of the Punjab are also becoming more common. A portion of the grant made to the Central Provinces for aided anglo-vernacular schools has been set apart for starting a provident fund for their teachers; a scheme has been framed which has met with the general approval of the managers.

13. As regards the increase of pupils, it was shown in the last quinquennial review that the number under instruction was 6,780,721. At the end of 1912-13, it was 7,160,944. At the end of 1913-14, it stands at 7,518,147. Hence, in the past two years, there has been an increase of 737,426 pupils, the increase in the second of those years over the first being 357,203. The percentage of those at school upon those of a school-going age is now 19·6, against 17·7 in 1911-12, and 18·7 in 1912-13. That on the total population is 3·0 against 2·7 and 2·8 in those same years.

The following table gives the figures province by province :—

Province.	Pupils at school. (Figures in thousands.)		Percentage of increase.	Percentage of the school-going population at school.
	1912-13.	1913-14.		
Madras	1,362	1,470	7·9	23·7
Bombay	988	1,029	4·2	25·3
Bengal	1,719	1,748	1·7	25·6
United Provinces	788	819	4·0	11·6
Punjab	411	440	7·2	14·7
Burma	460	505	9·9	27·8
Bihar and Orissa	847	862	1·7	15·6
Central Provinces	335	365	8·9	15·6
Assam	194	215	10·7	20·3
North-West Frontier Province	39	44	15·5	13·5
Coorg	7	8	6·5	21·0
Delhi	11	13	14·7	21·7
TOTAL	7,161	7,518	5·0	19·6

Burma, with its established system of monastic education, shows the largest results; and the figures are undoubtedly an underestimate in that province.* The increases in the North-West Frontier Province and in Delhi are remarkable. In regarding totals and percentages of education in India, it has always to be remembered that the female portion of the population contributes but a small fraction. The total of boys under instruction is 6,415,905, being 32·8 per cent. of boys of a school-going age, that of girls is 1,102,242, or 5·9 per cent.

The increase in the number of those who frequent colleges and secondary schools continues to out-run the increase of accommodation. It amounts to 8·2 per cent. upon the figures of students in those institutions last year. The increase of those who read in primary schools has amounted to 4·8 per cent. Strenuous efforts are being made to cope with the numbers. In the United Provinces alone grants for new school buildings or additional class-rooms aggregating over 4½ lakhs have been made to aided schools. One could wish that those in technical and industrial institutions would show a like rate of increase.

It is noteworthy that the number of girls at school has risen by 95,606—an increase which is probably without parallel in India and is certainly larger than in any one of the past five years. Muhammadan pupils have increased in number by 74,395 or 4·6 per cent.

14. In the sphere of university and collegiate education, efforts have largely concentrated themselves upon the planning of new universities and the organisation of university teaching and higher study. But this has not been to the exclusion of improvement in existing institutions. There has been much building activity both in university centres and in outlying colleges. A new departure has been made in Bombay with a College of Commerce and proposals for a school of Indian economy and sociology. *Development in various departments.*

The various provinces continue to work out or prepare schemes which are calculated to remedy the many admitted defects in secondary schools. The improvement in the terms of service of secondary and of primary teachers is a matter of radical importance; and this report shows that much has been done. The Government of Bengal have made proposals for the establishment of an institution run on public school lines, for the children of those who are willing to pay substantial fees. Local Governments continue to complete their surveys for the extension of primary education. The Government of the United Provinces summoned an important committee to discuss this and the whole question of elementary instruction.

As for professional education, facilities have been increased for the training of teachers—though they still fall far short of requirements. A scheme of extra-university medical instruction has been provided for by the creation of a College of Physicians and Surgeons in Bombay and of a State Medical Faculty in Calcutta. There has been no special development in technical and industrial education and (as remarked above) the increase of those who seek it might be accelerated with benefit. In connexion with the enquiries recently made by Colonel Atkinson and Mr. Dawson as to the relations of

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* Progress of education in India, 1907—1912; sixth Quinquennial Review, page 143.

technical schools and the employers of labour, it is gratifying to find that the Upper India Chamber of Commerce and the Bengal and North-Western Railway have rendered assistance in finding posts for students. Measures for the encouragement of oriental studies show steady progress, and the opening of the Sanskrit library at Benares is a marked step forward in realising the ideas of the Conference of Orientalists which met in Simla in 1911. Finally, the year has been marked by the visits of numerous educational specialists from other countries.

It should be added that the Advisory Committee for Indian Students in England was reconstituted during the year. The majority of its members are Indians. The committee is associated with the Central Bureau of Information which renders help to those students who desire its assistance.

II.—Universities and colleges.

15 The whole question of university organisation and expansion continues to evoke the keenest interest. The legislation of 1904 produced a measure of reform in the method of teaching up to the graduate stage. For reasons which are clearly stated in the report of the Indian Universities Commission, the new law did not attempt to change the prevalent system of federal universities: it prescribed but could not stimulate university teaching. A certain dissatisfaction has grown regarding that system: the Government of India have given grants for advanced study and research. Hence a stage of fresh problems has been reached. Activity has taken two forms.

In the first place, the movement in favour of new universities has continued. The intention is in some cases to produce a new type; *e.g.*, in the proposals for universities at Dacca, Aligarh and Benares. In others the main motive is the breaking up of excessively large areas and the identification of university and provincial spheres of jurisdiction, though here also the idea of developing along novel lines is present: in this class fall the proposals for Patna, Rangoon and Nagpur. None of these schemes has yet reached its conclusion: some are still in an inchoate stage. But the general approval of the Secretary of State was received during the year to the proposal for the Dacca University, the report of the committee constituted for the Patna University was issued, and progress was made elsewhere.

16. In the second place, there is the expansion of existing universities along new lines. In the previous year 16 lakhs had been made over to universities for capital expenditure and recurring allotments had been nearly trebled. In the present year 17 lakhs have been given for capital expenditure and the recurring allotments (including the earlier grants given) now stand at the following figures:—

	R
Madras University	90,000 a year.
University of Bombay	55,000 ,,
Calcutta University	1,28,000 ,,
University of Allahabad	85,000 ,,
Punjab University	45,000 ,,

These figures exclude the sums allotted for the initiation and maintenance of new universities.

17. The previous (comparatively small) grants made in 1904 were for the purpose of enabling universities to meet the cost of administration and inspection imposed upon them by the Act of that year. The more generous grants of the past two years have been expended on providing these institutions with buildings and libraries befitting their dignity, initiating systems of centralised teaching and examining resources for a forward movement. The building projects enumerated below have not all been completed; but a recital of these and of the recurring outlay which has taken place will show the trend of development in each centre. *Higher s*

The capital grant to the University of *Calcutta*, which amounted for the two years to 12 lakhs, is being expended on examination halls and the Hardinge Hostel for students of the University Law College, books and furniture for the library and the acquisition at a cost of 8 lakhs of an important site which abuts on the group of university buildings. The recurring funds are being utilised for an elaborate system of M.A. and higher instruction, including the creation of the George the Fifth Professorship of Mental and Moral Science and the Hardinge Professorship of Higher Mathematics (held by Professor Young, F.R.S.), the appointment of university readers, a large number of lecturers and additional expenses connected with the Law College. The university has also, out of its own funds, founded a Carmichael Professorship of Ancient Indian History and Culture and two professorships of English. Something will presently be said regarding the University College of Science which it is understood is being established out of benefactions. Thus the university has largely concentrated M.A. teaching in its own hands. Its policy has been criticised in some quarters as lacking in consideration for the facilities already existing in the larger colleges, instituting a somewhat haphazard system of lectures delivered, in return for low fees, largely by half-time lecturers, without suitable accommodation, the necessary tutorial arrangements or any effective residential supervision of its students. The defence that has been made is that colleges cannot cope with the number of M.A. and M.Sc. students which has suddenly risen to about 1,000 in the university classes (while in the preceding year it was about 500). To this it has been replied that the demand for this kind of instruction has been created by a lax system of qualifying lectures given in return for very low fees and frequently combined with attendance at the University Law College, and that colleges (which offer sounder facilities but limit their admissions to their actual teaching capacity) have not been consulted or brought into co-operation. It is reported that this policy has involved the university in financial difficulties notwithstanding the very liberal grants which the Government of India have made to it. The University of *Bombay* has refitted its library, but appears not to have launched out on any building operations. It secured the services of Sir Alfred Hopkinson as expert adviser, and proposed to spend small sums on the emoluments of scholars from England, on university lecturers and on its library. The position of things here as regards M.A. teaching is different from that prevalent in Calcutta, no less than nine out of 12 arts colleges enjoying affiliation up to the M.A. standard, while only four of the 45 arts colleges affiliated to the Calcutta University have such affiliation—and that only to a limited extent. At the close of the year a scheme for the establishment of a school of research in the field of Indian economics and sociology was approved and the Government of India have promised a recurring grant to the university for its support. The University of *Madras* is spending 6½ lakhs (including a provincial grant) on its libraries and the construction of a new university building. It has created a temporary professorship of Indian economics and a professorship of Indian History and Archæology, has appointed Mr. Neville, Fellow of Trinity College, Cambridge, lecturer in mathematics for the cold weather, and contemplates the development of the study of Indian languages upon

modern lines, for which purpose Dr. Mark Collins, Professor of Sanskrit and Comparative Philology in the University of Dublin, has been appointed to a chair in Madras. The *Punjab University* is extending its site, instituting hostels for its Oriental and Law Colleges, extending its library building and reorganising the Oriental College. It obtained the services of Professor Ramsay Muir and Dr. Smithells, F.R.S., during the cold weather to advise on the teaching of history and chemistry and to deliver lectures. The *University of Allahabad* has completed the building of its University Law School and is constructing and equipping a library and a law college hostel, has created professorships of Economics and Modern Indian History and has instituted readerships and scholarships.

nefactions d science iching.

18. It is significant that the subjects most generally chosen for centralised teaching are science, economics and Indian history and language. In Calcutta and Bombay large benefactions have recently been made for scientific teaching and research. The late Sir T. N. Palit and Dr. Rash Behari Ghose have handed over 25 lakhs to the Calcutta University. It is understood that a University College of Science will be instituted, staffed entirely by Indians; but Government has little information about the scheme and has not been consulted regarding it. In Bombay, benefactions have been given to the amount of 26 lakhs for a Royal Institute of Science in which will be provided all the science teaching now given at government arts colleges and possibly a large part of that given at privately managed colleges. The Local Government and the university are assisting the scheme, which is at present under consideration. The activity of the Bombay Presidency in creating facilities for science teaching has been noteworthy. Thanks to another generous endowment of nearly 8½ lakhs the Gujarat College had in the previous year acquired a valuable Science Institute on the donor's condition that the combined institution should henceforward be maintained by Government.

her developents.

19. The following are some of the principal developments of collegiate education in the different provinces :—

Two notable features in *Bombay* are the progress made in a scheme for a Royal Institute of Science (of which mention has just been made) and the opening in October of a College of Commerce. The report also speaks of proposals for a college at Dharwar, a college for Muhammadans and a college for women as under consideration. In *Bengal* the year presents a record of improvement or of the formulation of schemes in government colleges and of increase in the grant available for privately managed institutions. Speaking of *seminar* work in the Presidency College the report says:— "The work of the *seminars* showed a distinct advance; the organisation is more complete and the students have ceased to be apathetic, with the result that a co-operation in study previously unknown is developing between the members of the *seminars* and the presiding professors. Nevertheless the value of the *seminars* is considerably diminished by the fact that many students are primarily engaged in studying law and regard their reading for the M.A. as a secondary consideration." The report for the *United Provinces* also contains an interesting account of *seminar* work in the Muir Central College. An incident of note in these provinces was the opening by His Excellency the Viceroy on January 9th, 1914, of the new buildings of St. John's College, Agra. Progress is also recorded in the *Punjab*. The science side of the Government College continues to develop. Research work in botany, zoology and chemistry has been carried on there. A college herbarium of Indian plants has been started and a large biological laboratory was under construction. A college class has been opened in the Kinnaird High School for girls, Lahore. While the chief event in *Bihar and Orissa* was the publication of the report of the proposed Patna

University Committee, steady progress was made in the colleges. The staff was strengthened; new laboratories were commenced at the Patna College; aided colleges were improved with the result that the number of their students rose considerably. New buildings are being constructed for the Jubbulpore College in the *Central Provinces*, and it has been decided to establish a government college at Amraoti. In *Assam*, the development of the Cotton College, in point both of buildings and of extended affiliation, proceeds apace and the province is acquiring a self-contained system of collegiate education. The new Islamia College at *Peshawar* has shown remarkable progress. It was opened only the previous year and is a combined college and school of a purely residential type providing religious instruction. "Almost at once the demands for admission far exceeded the available accommodation. * * * It has already become a centre for those pupils from the agencies and the trans-border districts all round the province whose parents desire them to be educated but dislike sending their sons to the neighbouring schools in British territory."

It remains to narrate that the number of students in arts colleges has risen phenomenally in the past two years. In 1911-12 it was 28,196; in 1912-13 it was 32,049; at the close of 1913-14 it was 37,520. In the same period the number of institutions has increased by two and now stands at 125. Students in government colleges alone have increased by over 2,000.

III.—Secondary education.

20. The chief characteristic of secondary education continues to be a surprising increase in the number of those who seek it, with the result that here, as in the colleges, there is often some difficulty in accommodating all candidates. Secondary schools for boys have increased by 227 and pupils by 69,572 of whom 53,670 are undergoing instruction in English. The totals of institutions and scholars are 6,279 and 1,008,584 respectively. Of these 1,349 are high schools and 2,674 middle English schools containing respectively 466,459 and 316,465 pupils. The remainder is accounted for by middle vernacular schools. *Increase in numbers.*

21. The Government of India distributed during the year a capital allotment of R36,03,000. This was intended not only for secondary schools but also for colleges and training institutions. The following recurring grants were also made for secondary education :— *Imperial grants.*

	R
Madras	1,35,000
Bombay	95,000
Bengal	2,26,000
United Provinces	95,000
Punjab	95,000
Burma	67,000
Bihar and Orissa	95,000
Central Provinces	58,000
Assam	34,000
North-West Frontier Province	15,000

In 1912-13, recurring grants of the amount of R6,31,000 had been made for the same purpose. Thus the total addition to recurring funds made available during the two years for secondary education (exclusive of some small amounts sanctioned for Agencies, etc.) amounts to R15,46,000.

Developments.

22. The methods in which these grants have been expended and the schemes which are being formulated or brought into effect are briefly as follows:—

In *Madras* marked progress has been made in the improvement of accommodation and equipment, over 3¾ lakhs being spent on the latter. The scheme for the gradual improvement of secondary schools in *Bombay* was drawn up in 1911 and is being steadily worked out. Considerable capital expenditure has been incurred on a building for a high school in East Khandesh, extensions of other schools, hostels and playgrounds. A recurring sum of ₹26,000 a year was allotted for increasing the pay of assistant masters. Supplementary grants continue to be paid to aided schools bringing, it is reported, improvement in the teachers' salaries but not much in their quality. The most interesting development has been that of science teaching—a subject in which, as will have been seen from the preceding section, great activity has recently been displayed in this Presidency. An inspector of science teaching has been appointed, steps are being taken to provide laboratories in schools, and ₹33,000 has been sanctioned for the supply of apparatus. In *Bengal* it has not yet been found possible to introduce any general scheme for the improvement of secondary education. Hence the recurring grant of ₹2,26,000 was spent on building projects and furniture, while the bulk of the previous recurring allotment of 1½ lakh was devoted to increasing grants to aided schools. The report notices a novel development. "Many prominent men in Bengal have been emphasising for a long time the great need that exists for a residential school for Bengali boys conducted as far as possible on the lines of an English public school. During the year under review the Government of Bengal decided to satisfy, if possible, the demand without further delay. The Government of India agreed to lend Hastings House for this purpose, and a scheme is now before that Government for establishing a school on that property. Their idea is that the school should be temporarily housed at Hastings House, pending the working out of a scheme for re-establishing it outside Calcutta on a permanent basis and in buildings of its own." The Government of the *United Provinces* has long been following out the lines of a well considered scheme. New buildings have been erected both for Government and for aided schools, while special grants, sanctioned in the preceding year, have been made to the latter. A scheme for *Burma* has received the sanction of the Secretary of State. It will provide, at a cost of 12 lakhs capital and 3 lakhs recurring, for the maintenance by government of a few schools previously supported by municipalities, and the improvement of the staff of government, municipal and aided schools. Progress is being made with the scheme. The previous grant (of ₹60,000) in *Bihar and Orissa* was fully allotted during the year, and a comprehensive scheme calculated to cost ₹4·97 lakhs capital and ₹3·86 lakhs recurring was submitted, but did not receive the general approval of the Secretary of State till after the close of the period under review. Hence the new grant of ₹95,000 was handed over to District Boards for improvement of the buildings of middle English schools, while building operations were also conducted at certain government high schools and large building grants were given to private bodies. At present there are grave complaints of the inadequacy of the accommodation in most of the privately managed schools. The scheme alluded to, when carried out, will greatly improve the prospects of the staff in government schools and will raise privately managed schools by the help of grants to an efficient standard, a regular scale of pay being provided for their staff. At the beginning of the year an important scheme was sanctioned for the *Central Provinces*. The minimum pay of graduate teachers has been raised to ₹60 and of undergraduate teachers to ₹40, while corresponding improvements have been made in higher grades. Steps have been taken to raise certain government schools to the high standard as contemplated in the scheme. "The financial limitations to government enterprise are, however," says the Chief Commissioner's resolution, "beginning to be realised, and it may be hoped that, with the growth of enlightened public opinion, funds will be forthcoming from private sources which will facilitate the establishment of institutions which, with the aid of contributions from government, will be really efficient and will be able to supplement the

educational organisation of the province so as to meet the growing needs in this direction." There has been very great building activity. An inspectorship has been sanctioned for science teaching. No general scheme has been submitted from *Assam;* but the Chief Commissioner has laid down a definite policy, an important item in which is the transfer to government of the majority of aided schools at sub-divisional headquarters. In pursuance of this policy, says the resolution, "six aided high schools at sub-divisional headquarters were provincialised during the year; a scheme was sanctioned for the development of government high schools so as to provide for existing requirements and for the expansion anticipated at the beginning of the succeeding year; middle English schools were opened at certain centres to relieve the pressure on the lower classes of the high schools; unaided high schools were taken on to the aided list, and assistance was given to aided schools on a generous scale to enable them to keep pace with the improvements effected in government institutions." A scheme for high schools in the *North-West Frontier Province* was sanctioned, in pursuance of which certain municipal schools were taken over by government and the grant-in-aid rules were revised on a liberal scale so as to encourage private enterprise.

Thus the majority of provinces have now approved schemes to work upon. It remains to provide funds to carry out those portions to which effect have not yet been given.

Defects of the matriculation examination.

23. The question of the matriculation examination is beginning to excite considerable controversy. This examination represents the goal of school work and hence dominates both the subject matter and the method of instruction in high and even to some extent in middle schools. At the same time, it provides the machinery for testing the fitness of pupils to enter on university courses and thus affects by its character the quality of the material supplied to colleges. A strong feeling is growing among educationists and others that success at the matriculation is an insufficient proof of ability to attempt higher studies and actually tends in some provinces to become cheaper, and that the only salvation of the colleges is to purge them of what is in reality a school-boy element.

The Bombay report comments on the sudden rise in the number of successful candidates at matriculation from 34 to 58 per cent. and states that the phenomenon is apparently not attributed to any great improvement in the teaching of the schools. It quotes a remark of Sir Alfred Hopkinson to the effect that "an examination in mathematics with only three per cent. of failures among candidates drawn from schools of all kinds and most various degrees of efficiency must be entirely inadequate as a guarantee of any knowledge of the subject." It is given as the general opinion of the professors who are concerned with teaching the first year class at St. Xavier's College, Bombay, that at least one-third of the students (apparently over 300 in number) are not fit for the course prescribed by the university. The principal of the Dayaram Jethmal Sind College at Karachi makes a similar complaint and surmises that this may result in a lowering of the higher university examinations. (In this connection, it is interesting to observe that Principal Paranjpye of the Fergusson College, Poona, is of opinion that the new B.A. pass course recently introduced in Bombay is too meagre to occupy a student for two years.) The resolution of the Government of Bombay comments on this apparent lowering of the standard of matriculation and the consequent unprecedented influx of first year students, a large proportion of whom cannot be regarded as properly pre-

pared for higher education. It is reported from the United Provinces that boys migrate into Bihar owing to the impression that the Calcutta matriculation is easier than that of Allahabad. The resolution on the report states that "the colleges are congested with students whose inadequate attainments render them unfitted to benefit by a university training, and an extension of the school course, involving possibly the taking over by the schools of some of the college classes, seems to be required as much in the interests of collegiate as of secondary education."

Remedies.

24. Various proposals have been made for remedying this state of affairs. One is the substitution for the matriculation of a more intelligent form of test. This already exists as an alternative in Madras, Bombay and the United Provinces, though in Bombay it does not admit to the university. In Madras 4,860 secondary school-leaving certificates were completed during the year. It is stated in the United Provinces report that principals of colleges are finding that students who have passed the school-leaving certificate examination are, as a rule, better able to understand and converse in English. Burma too has a high school final examination; the number of those who take it, though small, is growing. Bihar and Orissa have appointed a committee to consider the question of a school-leaving certificate and the North-West Frontier Province has referred a scheme to the Punjab University. The Government of India have declared themselves in favour of some sort of test which gives consideration to the school record. Another proposal now frequently put forward is the elongation of the school course so as to include all or a portion of the intermediate stage of instruction. In the Imperial Legislative Council, the Hon'ble Pandit Madan Mohan Malaviya advocated the teaching of the intermediate standard in all high schools, the student subsequently taking his degree at a college in three years. Dr. Tej Bahadur Sapru, addressing the Provincial Conference at Meerut, suggested that the first year of the intermediate stage should be relegated to the high schools. The Bombay report quotes the opinion of Dr. Mackichan, principal of the Wilson College, who would like to see the number of students in the first year reduced and thinks that at least one year should be added to the high school course, so that students should complete in school the work that they now do in the first year of the college course.

IV.—Primary education.

Progress.

25. The increase in the number of pupils reading in public primary schools for boys during the quinquennium 1907—1912 was 891,980. No higher quinquennial increase had been recorded. The figures for the past three years are:—

	Number of primary schools for boys	Number of pupils in boys' primary schools.	Increase of pupils.
1911-12	110,692	4,522,648	..
1912-13	111,021	4,768,043	245,395
1913-14	116,650	4,973,916	205,873

Thus, in two years, there has been an increase of 451,268 pupils in primary schools. The provincial figures are as follows :—

Province.	Number of boys' primary schools.		Number of pupils reading in boys' primary schools.		Increase or decrease of pupils.
	1913.	1914.	1913.	1914.	
Madras	25,223	26,018	1,015,106	1,089,478	+74,372
Bombay	12,169	12,790	723,815	750,985	+27,170
Bengal	28,107	27,470	1,047,255	1,028,484	—18,771
United Provinces	10,158	10,411	547,534	566,156	+18,622
Punjab	3,689	4,158	197,663	220,555	+22,892
Burma	4,733	5,046	162,637	189,038	+26,401
Bihar and Orissa	22,452	22,509	637,634	644,223	+6,589
Central Provinces	3,471	3,846	261,406	289,539	+28,133
Assam	3,534	3,760	148,278	161,730	+13,452
North-West Frontier Province	335	440	16,899	22,301	+5,402
Coorg	84	93	5,909	6,550	+641
Delhi	69	76	3,907	4,877	+970
TOTAL	114,024	116,650	4,768,043	4,973,916	+205,873

All the provinces have contributed to the increase save Bengal, where both schools and pupils have declined. The causes of the decline are mentioned later.

As remarked in the last quinquennial review, the figures given in the preceding paragraph do not disclose the whole truth. Some of the pupils reading in boys' schools are girls while boys are also found in girls' schools. The pupils reading in the primary stages of secondary schools and in some of the other public and private institutions which impart primary education have to be added in. The calculation of those undergoing elementary instruction is as follows :—

	Boys.	Girls.	Total.
In primary stage of public schools	5,117,529	970,423	6,087,952
In other public schools giving primary education	141,570	25,018	166,588
In elementary private schools teaching a vernacular	349,164	19,478	368,642
TOTALS	5,608,263	1,014,919	6,623,182

Seven years ago the total of children in the elementary stage of instruction was $4\frac{7}{10}$ millions; two years ago it was 6 millions; in the past year it was $6\frac{2}{3}$ millions, or 17·3 per cent. of the population of a school-going age—namely 28·7 per cent. in the case of boys and 5·4 per cent. in the case of girls.

26. This advance was to a large extent made possible by the grants allocated to elementary education. In considering these grants, it is not only the sums made available in 1913-14, which have to be taken into consideration, but those of the previous years also. Primary education is a matter of slow mobilisation and the effect of disbursements becomes apparent only *Imperial grants.*

gradually. The grants recently made in the nine major provinces for this object have been :—

	Non-recurring.	Recurring.
	₹	₹
1911	9,95,000	...
1912	90,000	30,00,000
1913	84,00,000	19,35,000

The financial effect has been as follows :—

	Amount contributed to boys' primary schools in			Percentage to total expenditure.		
	1912.	1913.	1914.	1912.	1913.	1914.
	₹	₹	₹			
Public funds	1,17,91,788	1,32,38,070	1,54,81,800	65·6	66·7	69·7
Fees	40,87,951	42,98,114	43,06,738	22·8	21·6	19·4
Other private funds	20,82,714	23,30,107	24,32,872	11·6	11·7	10·9
TOTAL .	1,79,62,453	1,98,67,251	2,22,21,410	100·0	100·0	100·0

Thus public funds are coming to take a proportionately larger share in meeting the cost of elementary education, and the amount of fees collected, though it has increased, shows proportionate diminution.

It is necessary to consider how far expenditure on primary education keeps pace with the allotment of additional grants. The recurring grants took effect first in 1912-13 and now amount to ₹49,35,000 annually. The increase in annual expenditure on the maintenance of primary schools for boys since 1911-12 (the year before the grants were made) is now ₹34,44,000. This, however, does not necessarily mean that grants have not been spent. For some Local Governments, such as those of Bengal, Bihar and Orissa, Burma and the Central Provinces (which show a shortage in recurring expenditure) spent a portion of their grants on capital objects. (Such expenditure is not included in the expenditure figures given above; and the statistics regarding money employed on buildings and furniture do not distinguish between primary and other grades of institutions.) It is also probable that some portion of the grants has been utilised in indirect expenditure, such as training, the cost of inspecting staff, etc.

Developments.

27. In the primary department of education interest centres round the schemes of expansion and improvement made possible by the liberal grants of recent years.

Madras records an addition of 794 public elementary schools for boys. In *Bombay* an extensive programme has been framed and 621 primary schools for boys were opened during the year. *Bengal* on the other hand shows a decrease of 637 institutions. Throughout the presidency there has been a falling off in the number of upper primary schools, for which, says the report, there is apparent lack of enthusiasm. The decrease in the number of lower primary schools is confined to the western districts and is explained as due to various causes—floods, closer inspection and the conversion of some schools into *maktabs*. "The increase in the number of lower primary schools in Eastern Bengal," says the report, "is due mainly to the number of these institutions of an improved type which have been founded in *panchayati* unions and for which funds have been liberally given to district boards. This scheme of expansion of primary education has just been introduced into Western Bengal; and it is hoped that succeeu-

ing reports will be able to announce an all-round advance in the numerical strength of primary institutions." The decrease in pupils attending primary schools is 18,771. The main lines of advance will be the establishment of model primary schools and the provision of buildings for aided schools. In the *United Provinces* an important committee has gone thoroughly into the question of primary education, schools and scholars show an increase (the latter of 18,622), and various steps have been taken to secure some permanence or guarantee of solidity in aided institutions. Programmes of extension have been drawn up by many boards in the *Punjab*. Numbers show an increase. The following passage in the report is of interest. "The theory that there should be central upper primary schools surrounded by lower primary branches does not find favour in this province; the demand is everywhere for a complete primary school and for a board school in preference to an aided one." The system of central schools surrounded by branches has, on the other hand, been recommended by the committee in the United Provinces. *Burma* records a very satisfactory advance, mainly in monastic schools, which will offer a simple curriculum. *Bihar and Orissa* shows a moderate increase. The report and the resolution combat the charge that the grants should have been used to increase the number of schools rather than their efficiency. The resolution says:—"At the last census it was found that in Bihar and Orissa the proportion of persons between the ages 15 and 20 who were literate was less than one-third of the proportion between the ages 10 and 15 who were at school—in other words that very large numbers of children leave school either wholly unable to read and write or so poorly equipped in this respect that five years suffice to obliterate altogether the results of the meagre teaching that they have received."* In the *Central Provinces* and *Assam* the increases have been considerable—particularly in the former. In Assam education has been made free in middle vernacular and upper primary classes. This has had an excellent effect in increasing the number of pupils in middle vernacular institutions. The *North-West Frontier Province* also shows a satisfactory increase in the same class of institutions, along with a general increase of schools and pupils.

28. Some of the reports emphasise the difficulty experienced in obtaining a satisfactory type of building for primary schools. The essentials of such a building are cheapness, space, good ventilation and light. The Bombay report speaks of a type of house with dwarf walls and a roof supported by pillars, which is common in Ceylon. Furniture is stored in a small room which is constructed at one end of the building and can be locked up. Matting is sometimes provided, to be let down as a protection against wind. Coolness is ensured by a roofing of straw or locally made tiles. But often quite half the children are taken out to work under trees for the greater part of the school period. Similarly, the Punjab report says that what is required for a small village school is some form of open airy shelter, which need not cost much, supplemented by a shady tree if possible. On the other hand, what actually happens is that a few comparatively expensive buildings are erected, while elsewhere "classes are held in private houses where boys are huddled together like sheep in a pen and can hardly breathe." The Director recommends a shady tree and a light shelter against rain with a store-room for apparatus. Needless to say, no single type will suffice for the varying climatic conditions and the different materials found throughout India. *Type of building.*

29. The difficult problem of providing suitable education for children engaged in industries deserves special attention and more notice in reports than it sometimes receives. The Bombay report mentions the opening of a *Children employed in industries.*

* Compare sixth Quinquennial Review, para. 324.

few factory schools—in most cases without success. The following account of similar attempts in Bihar and Orissa deserves quotation in full :—" During the year a half-time school was established in connection with the Peninsular Tobacco Company's Factory at Monghyr. It has proved very successful and has now 453 children on its rolls. Night schools were also established at Sahebganj for the children employed in the Sabai Grass Industry and at Sakchi for children employed in the Tata Company's Works, while 7 such schools were established in the Dhanbaid sub-division for children employed in the mica factories. In addition to these schools the East Indian Railway Company maintains, with the help of a district board grant, 31 schools near Giridih for the children employed in its collieries there. There are few large factories in the province, but it will be seen that active steps have been taken for the education of the children employed in the larger industrial concerns." In Assam there are now 119 schools for tea garden children.

V.—*Professional and special education.*

General figures.

30. The number of students in professional and special schools and colleges has risen from 204,600 to 213,864. The main developments are shown in the following paragraphs. The subject of the training of teachers has been partially treated above (page 6). There is nothing particular to record about legal education save what has already been said in section II and the fact that the numbers of those who study law have increased from 3,877 to 4,083.

Training of teachers.

31. The number of those under training for the teachers' profession is 17,190, against 15,541 in 1912-13. The record is generally one of increase in the number of training classes with a view to meeting the demand for teachers raised by the distribution of grants and the creation of new schools. The following developments are noticed. In *Bombay* the scheme has been tried and has succeeded of utilising diploma-holders of the secondary training college for giving instruction in teaching to masters of aided high schools in Poona and for supervising their actual teaching in schools. *Bengal* has a network of 117 *guru*-training schools for elementary teachers. The greater number of these are in the western districts, the policy pursued in Eastern Bengal having been one of increasing the numbers in existing schools and improving the staff but not of multiplying the institutions. In 1908 the Government of Eastern Bengal and Assam had framed a scheme for still further accentuating this policy and improving the schools. A scheme has now been drawn up on the lines of this Eastern Bengal scheme for placing all these institutions on an improved footing. In Eastern Bengal several schools of this type have already been built; and it is hoped with imperial revenues to extend the improved schools throughout the Presidency. In the *Allahabad Training College* special courses have been arranged in certain subjects and are much appreciated. The direct method of teaching English is said to have produced encouraging results in the practising school. In the *Central Provinces* re-training classes have been opened. In *Assam* the period of training at the normal schools has been extended to three years.

32. The encouragement of oriental studies is a point on which the Government of India have recently laid stress, as was indicated by the assembling of a conference on the subject in 1911. It is difficult to gauge progress here. During the past two years the numbers in oriental colleges have increased by 217 and now stand at 1,669. But this by no means represents the total of those engaged in such studies. The private institutions which teach oriental classics show an increase of 5,032 pupils, the total now standing at 60,232. In many of these, however, the instruction is not of a high order. Some of the special public schools are engaged on similar work; but it is impossible to distinguish the precise number of these. As already noticed, some of the universities have created chairs of oriental studies. The Calcutta University has founded a Carmichael Professorship of Ancient Indian History and Culture. Madras has secured the professor of Sanskrit and comparative philology in the University of Dublin to fill the chair of philology. The Punjab University has made new appointments in its oriental college. The University of Allahabad has created a chair of post-Vedic studies, and the report of the United Provinces has an interesting description of the Princess of Wales Saraswati Bhawan or Sanskrit library at Benares, which has been constructed and equipped by liberal contributions and a government grant, and was opened by the Lieutenant-Governor during the year. "It provides not only a library, where the Sanskrit manuscripts are securely and suitably housed, but reading and lecture rooms where students of Sanskrit may have opportunities for receiving instruction and for quiet study with ready access to materials for research. It is intended to foster higher Sanskrit studies both on oriental and western lines, to be a meeting place of the East and the West, of the old and the new, where the traditional learning of the *pandit* may be linked with the scientific methods of critical scholarship. Of the offspring of this union high hopes are entertained." In addition, posts have been created of a superintendent of Sanskrit studies and of an inspector of pathshalas. The Government of India have made a grant to the Asiatic Society of Bengal to enable that body to utilise the services of Dr. L. P. Tessitori in editing the bardic chronicles of Rajputana. Various Local Governments have framed schemes, some of them after calling committees to consider the subject. The resuscitation of higher scholarship on a liberal scale and the blending of *pandit* lore with modern critical research will be a slow process; but the process has commenced. *Oriental studies.*

33. A school of tropical medicine was sanctioned for Calcutta, and the foundation stone was laid in February 1914. The buildings are now complete and it was hoped that the school would be opened early this year. It is possible, however, that in consequence of the war there may be some postponement. Steady progress was made with the improvement and re-construction of the bacteriological laboratory at Parel which will be converted into a school of tropical medicine similar to the one which has been started in Calcutta. *Medical education.*

A scheme was submitted to the Secretary of State for rendering assistance to the College of Physicians and Surgeons of Calcutta associated with the Albert Victor Hospital at Belgachia. This independent medical institution will now be affiliated with the Calcutta University, and its qualifica-

tions will be recognised by Government. In Bombay a College of Physicians and Surgeons was established for the granting of licenses and diplomas to college students who are not prepared to proceed for university degrees. A similar body, called the State Medical Faculty, was founded in Calcutta. Medical Registration Acts were passed for the presidencies of Madras and Bombay and for the province of Bengal.

Arrangements were made for the improvement of medical education in Madras and for the re-organisation of the teaching staff at the Madras Medical College. A scheme was approved for founding a medical college for women and a training school for nurses at Delhi. The foundation stone of this school was laid by Her Excellency the late Lady Hardinge the day before she left for England in February. A proposal was brought forward for the creation of post-graduate classes at the King George's Medical College, Lucknow, for civil assistant surgeons, and the question of the establishment of similar classes in other provinces is under consideration. The Women's Christian Medical College at Ludhiana for the training of female sub-assistant surgeons, compounders, and nurses was formally recognised by government and received a grant-in-aid. It continues to make good progress.

A scheme was introduced in Madras whereby officers of the Indian Medical Service and civil assistant surgeons serving in the Madras Presidency are now deputed to the Government Ophthalmic Hospital in Madras for definite periods in order that they may receive a systematic course of instruction in ophthalmology. A scheme for improving the training of military assistant surgeons who will in future undergo a five years' course of training similar to that given to civil assistant surgeons was sent home for the approval of the Secretary of State. His approval has now been received.

Technical and industrial education.

34. The numbers in engineering and surveying schools show a slight decline, those in technical and industrial schools an increase of nearly 2,000. The number in both together is now 13,570, an utterly inadequate total when it is considered that there are over 47,000 students in arts and professional colleges and over a million pupils in secondary schools. Few facts about education in India are so important and significant as the comparative paucity of those who are preparing for a technical career. The report from Bihar and Orissa, in remarking upon it, says that the new survey class was designed to admit 50 pupils every year, but last year only 14 were admitted, and that the admissions to the sub-overseer courses fell off. Again, the District Board of Bahraich (United Provinces) opened a carpenters' school in 1913 in order to test the reality of the demand for technical instruction; notwithstanding all efforts, the carpenters asked that their boys should be paid to attend and outside the carpenter class only two or three pupils presented themselves.

In Madras a good deal has been done towards the improvement of the tannery industry and the manufacture of tanning extracts. The Sir Jamsetjee Jheejeebhoy School of Art and the Victoria Jubilee Technical Institute, Bombay, show satisfactory progress. The equipment of the

technical schools at Lucknow and Gorakhpur and of the carpentry school at Bareilly has been much improved. An interesting development is reported from the weaving schools in Bihar and Orissa, where the cost of the yarn will be paid by government and recouped from the sale of manufactured articles, while the balance, supplemented by a further grant, will form a fund for the purchase of looms for successful students. It is proposed to open a third mining class in the coal-fields. The buildings of the engineering school at Nagpur have been completed.

Agricultural education.

35. During 1913-14 the question of making drastic changes in the curricula of the various agricultural colleges in order to attract the right class of men to them and thereby to increase their usefulness and popularity came into especial prominence and was one of the principal subjects discussed at the meeting of the Board of Agriculture held at Coimbatore in December 1913. The only changes actually carried out at agricultural colleges during the year under review were in the Central Provinces where the curriculum of the Nagpur College was altered in the direction of concentrating chemistry and botany in the first two years and of paying more attention to agriculture, veterinary science and engineering in the third year, and in the United Provinces where the *kanungo* students were removed from the Cawnpore College, a separate school being established for them.

Forestry education.

36. The new buildings of the Forest Research Institute at Dehra Dun were completed during the year.

Veterinary education.

37. A post-graduate course in veterinary bacteriology and sanitary science to which a certain number of members of the civil veterinary department will in future be deputed annually was initiated at the Bombay Veterinary College.

VI.—Education of special classes.

38. In a short review like the present it is not necessary to deal with the subject of special classes under every head. Thus, nothing is said of the education of chiefs, since there has been no special development during the year.

Education of girls.

39. The number of girls in public institutions has increased from 929,927 to 1,019,544 and the total from 1,006,636 to 1,102,242. Only 5·9 per cent. of the female population of school-going age are at school. The actual figures are still small. The proportionate increase is satisfactory in that it is the highest annual increase on record. Beyond these figures there is not much to note in the way of general movements. The imperial grants have permitted of the opening of new schools. The Government of Bengal are experimenting with *panchayati* union girls' schools—presumably a pendant to the boys' schools of that species. It is recorded that in Madras the number of Muhammadan girls at school has more than doubled in the last two years. Several reports speak of the large increase in the number of girls reading in boys' schools. The admission of girls into the lower classes for boys is often the prelude to the establishment of a girls' school. A form of education which does not appear to have given satisfaction is *zenana* teaching. In the Punjab it has not been generally successful; and the demand for it

is small. The reports from the United Provinces and Bihar and Orissa speak unfavourably of it. In Bengal alone the work is considered to be full of promise.

The framing of suitable curricula for girls' schools is exercising the minds of educationists, especially in the Punjab, where Queen Mary's College takes the lead in modern methods of instruction. The Inspectress in Bengal considers that the work of education is subordinated to the idea of a "pass," and the social and domestic aspects of school work are neglected. She does not consider the matriculation to be of real value in girls' schools. It is comforting to hear that in an aided *purdah* Urdu school in Bombay instruction in first aid and nursing is regularly imparted by an experienced teacher to the higher classes.

From almost every province the cry is for more women teachers. This want is undoubtedly one of the main stumbling blocks in the education of girls. Its solution on a large scale is still to seek. Among the steps which are being taken, it may be mentioned that Madras has a hostel for Brahman widows at Triplicane. It contains 25 boarders.

European education.

40. Work has progressed in the matter of European education along the general lines indicated at the Simla Conference of 1912. Grants have been made for this purpose, including R40,000 and R30,000 for the education of the poor in Calcutta and Madras city respectively. The increase in the number of pupils has been 2,902, and the total now stands at 37,809, exclusive of Bangalore and other places not covered by provincial reports. According to the calculation made in the sixth quinquennial review, over 15 per cent. (if Bangalore is included, over 16 per cent.) of the total domiciled community are at school. Numerical progress has been most marked in Madras and Bombay, the pupils rising by 11·8 and 10·2 per cent. The scheme for the establishment of a training college for Europeans in southern India (in addition to the class at Sanawar, which makes provision for upper India) is being considered. Salaries have been increased and better teachers are employed in consequence. In Madras grants have also been used for the establishment of classes for physical training and domestic economy. A manual training class for teachers was held in Bengal. The Lawrence institutions at Murree and Sanawar have been improved. The Punjab resolution says, "The year has been one of steady progress, and there is no longer any difficulty in obtaining a good education in a hill climate at moderate expense for children of the Anglo-Indian community."

Muhammadan education.

41. In April 1913, the Government of India issued a circular containing suggestions on the education of Muhammadans. It was pointed out that this section of the community, while it now held its own in the primary schools, was still backward in the higher grades of instruction. The measures of improvement suggested were that *maktabs* should be encouraged to adopt a secular course, that the teaching of Urdu should be provided where necessary and that special text-books should be framed for semi-secular *maktabs*. It was thought that existing madrassas and Islamia colleges and schools should be improved and new schools established for Muhammadans in suitable localities. The provision of Muhammadan

hostels and the appointment of Muhammadan teachers and inspectors and of a reasonable number of Muhammadans to committees and governing bodies of institutions were also mentioned among other matters requiring attention. These are still under the consideration of some of the Local Governments.

Muhammadan pupils have risen from 1,625,054 in 1912-13 to 1,699,449 or by 4·6 per cent. against an increase of 4·8 per cent. among Hindus. The remarkable increase in the number of Muhammadan girls at school in Madras has already been noticed. Similarly in Bengal the increase among Muhammadan girl pupils was more than four times the increase of the previous year, though the Director observes that the progress made by Muhammadans as a whole is very slight. In Bihar and Orissa there was a slight decline.

It is interesting to find that in several reports mention is made of the readiness of Muhammadans to enter the common schools and of the unpopularity of special institutions. Notwithstanding satisfactory progress in the number of Muhammadan pupils in Madras, schools chiefly intended for this class of the community decreased and their pupils fell off by over 10,000. The Muhammadan high school in Bombay, which offers many advantages, is shunned by those who can afford to send their children to other institutions. The Director in Burma, in answering the question whether Muhammadans are really apathetic in the matter of education, says that their only apathy seems to be in not wishing to send their children to purely Muhammadan schools.

Muhammadans still show hesitation in entering technical schools. The resolution on education in the Punjab quotes the following extract from the presidential address recently delivered at the All-India Muhammadan Educational Conference. " Thirty years ago the cry of the Indian Mussalmans used to be the cry of despondency, that in the matter of English education we have allowed ourselves to lag behind. Thirty or forty years hence I am afraid the burden of our cry would be that we have fallen behind all other communities in the peaceful avocations of manufactures, commerce and industry."

The progress made at the Islamia College, Peshawar, has been mentioned. The Government of India have now made a liberal recurring grant to the Islamia College at Lahore, while the Government of the Punjab has given over 1¼ lakh as building grants to Muhammadan high schools and has accorded concessions by way of enhanced scholarships and remission of fees.

APPENDIX.

t showing province by province the amounts of imperial grants placed at the disposal of the Local Governments over and above the expenditure in 1910-11 and the amounts expended by them.

nce.	Particulars.	1910-11.	1911-12.		1912-13.		1913-14.	
		R (In lakhs.)		R (In lakhs.)		R (In lakhs.)		R (In lakhs.)
	Available .	..		57·61		57·61		57·61
			Non-recurring grant.	6·57	Balance, non-recurring.	4·53	Balance, non-recurring.	1·22
			Total .	64·18	Recurring grant .	10·00	Previous recurring grant.	10·00
					Non-recurring grant	8·70	New recurring grant	6·83
					Total .	80·84	New non-recurring grant . .	49·00
							Total .	124·66
	Spent .	57·61		59·65		79·62		95·26
	Balance .	..		+4·53		+1·22		+29·40
	Available .	..		66·98		66·98		66·98
			Non-recurring grant.	11·02	Balance, non-recurring.	3·12	Excess in 1912-13 .	4·44
			Total .	78·00	Recurring grant .	7·75		62·54
					Non-recurring grant	8·00	Previous recurring grant.	7·75
					Total .	85·85	New recurring grant	5·93
							New non-recurring grant. . .	38·75
							Total .	114·97
	Spent .	66·98		74·88		90·29		90·60
	Balance .	..		+3·12		—4·44		+24·37
	Available .	...		63·38		60·92		60·92
			Non-recurring grant	24·50	Balance, non-recurring.	+19·78	Balance, non-recurring.	38·54
			Total .	87·88	Recurring grant .	12·25	Previous recurring grant.	12·25
					Non-recurring grant	28·00	New recurring grant	13·56
					Total .	120·95	New non-recurring grant . .	75·00
							Total .	200·27
	Spent .	63·38		68·10		82·41		88·92
	Balance .	..		+19·78		+38·54		+111·35

APPENDIX.

Statement showing province by province the amounts of imperial grants placed at the disposal of the Local Governments over and above the expenditure in 1910-11 and the amounts expended by them—contd.

Province.	Particulars.	1910-11.	1911-12.		1912-13.		1913-14.	
		R (In lakhs.)		R (In lakhs.)		R (In lakhs.)		R (In lakhs.)
United Provinces .	Available .	..		59·24		59·24		59·24
			Non-recurring grant.	15·91	Balance, non-recurring.	7·57	Balance, non-recurring.	3·23
			Total .	75·15	Recurring grant .	8·25	Previous recurring grant.	8·25
					Non-recurring grant	6·50	New recurring grant	6·51
					Total .	81·56	New non-recurring grant . .	42·30
							Total .	119·53
	Spent .	59·24		67·58		78·33		81·94
	Balance .	..		+7·57		+3·23		+37·59
Punjab . .	Available .	..		31·99		31·99		31·99
			Non-recurring grant	9·00	Balance, non-recurring.	5·23	Excess in 1913-14 .	·60
			Total .	43·99	Recurring grant .	4·60		34·39
					Non-recurring grant	4·50	Previous recurring grant.	4·60
					Total .	40·32	New recurring grant	3·81
							New non-recurring grant . .	25·25
							Total .	68·05
	Spent .	31·99		38·76		40·02		54·77
	Balance .	..		+5·23		—·60		+13·28
Burma . .	Available .	..		24·27		24·27		24·27
			Non-recurring grant	8·00	Balance, non-recurring.	5·39	Balance, non-recurring.	3·53
			Total .	32·27	Recurring grant .	3·00	Previous recurring grant.	3·00
					Non-recurring grant	1·50	New recurring grant	3·07
					Total .	34·16	New non-recurring grant . .	24·25
							Total .	58·12
	Spent .	24·27		26·88		30·63		35·86
	Balance .	..		+5·39		+3·53		+22·26

APPENDIX.

showing province by province the amounts of imperial grants placed at the disposal of the Local Governments over and above the expenditure in 1910-11 and the amounts expended by them—contd.

nce.	Particulars.	1910-11.	1911-12.	1912-13.	1913-14.
		R (In lakhs.)	R (In lakhs.)	R (In lakhs.)	R (In lakhs.)
Orissa .	Available .	..	..	27·32	27·32
				Recurring grant . 5·30	Balance . . 3·04
				Non-recurring grant 3·00	Previous recurring grant. 5·30
				TOTAL . 35·62	Now recurring grant 5·23
					New non-recurring grant . . 33·78
					TOTAL . 74·67
	Spent .	..	27·32	32·58	45·91
	Balance .	..	..	+3·04	+28·76
ovinces .	Available .	..	24·41	24·41	24·41
			Non-recurring grant. 4·00	Balance, non-recurring. 2·76	Balance, non-recurring. 2·17
			TOTAL . 28·41	Recurring grant . 2·95	Previous recurring grant. 2·95
				Non-recurring grant 1·50	New recurring grant 2·69
				TOTAL . 31·62	New non-recurring grant . . 17·75
					TOTAL . 49·97
	Spent .	24·41	25·65	29·45	31·50
	Balance .	..	+2·76	+2·17	+18·47
	Available .	..	..	11·04	11·04
				Recurring grant . 1·85	Balance, non-recurring. ·20
				Non-recurring grant 1·00	Previous recurring grant. 1·85
				TOTAL . 13 89	New recurring grant 1·77
					New non-recurring grant . . 13·00
					TOTAL . 27·86
	Spent .	..	11·04	13·69	17·34
	Balance .	..	..	+·20	+10·52

APPENDIX.

ent showing province by province the amounts of imperial grants placed at the disposal of the Local Governments over and above the expenditure in 1910-11 and the amounts expended by them—contd.

ovince.	Particulars	1910-11.	1911-12.		1912-13.		1913-14.	
		R (In lakhs.)		R (In lakhs.)		R (In lakhs.)		R (In lakhs.)
est Fron-ovince.	Available .	..		2·88		2·88		2·88
			Non-recurring grant.	·58	Balance, non-recurring.	·37	Excess in 1912-13 .	·01
								2·87
			TOTAL .	3·46	Recurring grant .	1·06	Previous recurring grant.	1·06
					Non-recurring grant	4·18	New recurring grant	·70
					TOTAL .	8·49	New non-recurring grant . .	1·00
							TOTAL .	5·63
	Spent .	2·88		3·09		8·50		5·86
	Balance .	..		+·37		—·01		—·23
	Available .	..		·43		·43		·43
			Non-recurring grant.	·25	Balance, non-recurring.	·14	Balance, non-recurring.	·07
			TOTAL .	·68	Recurring grant .	·03	Previous recurring grant.	·03
					Non-recurring grant	·37	New recurring grant	·11
					TOTAL .	·97	TOTAL .	·64
	Spent .	·43		·54		·90		·73
	Balance .	..		+·14		+·07		—·09
	Available .	..		..	A grant of R1,00,000 was made for St. Stephen's College, Delhi.		Recurring grant .	1·45 ·25
							Non-recurring grant	·34
							TOTAL .	2·04
	Spent .	..		..		1·45		1·43
	Balance .	..		..		..		+·61

APPENDIX.

showing province by province the amounts of imperial grants placed at the disposal of the Local Governments over and above the expenditure in 1910-11 and the amounts expended by them—concld.

nce.	Particulars.	1910-11.	1911-12.		1912-13.		1913-14.	
		R (In lakhs.)		R (In lakhs.)		R (In lakhs.)		R (In lakhs.)
Bengal m.	Available	..		35·90		..		..
			Non-recurring grant	11·17				
			TOTAL .	47·07				
	Spent .	35·90		40·11		..		..
	Balance .	..		+6·96		..		..
	Available .	..		370·09		370·09		370·09
			Non-recurring grant	91·00	Balance, non-recurring.	55·86	Balance, non-recurring.	52·47
			TOTAL .	461·09	Recurring grant .	57·04	Previous recurring grant.	57·04
					Non-recurring grant	67·25	New recurring grant	50·47
					TOTAL .	550·24	New non-recurring grant . .	320·42
							TOTAL .	850·49
	Spent .	370·09		405·23		497·77		550·11
	Balance .	..		55·86		52·47		300·38

.—There is a discrepancy between the balances as shown for the provinces in detail and the figure for all-India. e to the adjustment of grants consequent on the redistribution of territories in 1912. The result is that the all-India the end of 1913-14 is short of the addition of the detailed figures by R4,07,000.

xpenditure in Coorg during 1910-11 was reported as R74,000. As this far exceeds any previous expenditure (and even diture in 1911-12) it has been thought better to enter the 1909-10 figure in the first column of figures as being more normal and tive.

GENERAL TABLES.

1913-14.

ABSTRACT STATEMENT OF COLLEGES, SCHOOLS AND SCHOLARS IN THE [illegible]
OFFICIAL YEAR 1913-14.

(For details see General Table III.)

AREA AND POPULATION.			Particulars.	PUBLIC INSTRUCTION.								PRIVATE INSTITUTIONS.			GRAND TOTAL.	AVERAGE NUMBER OF TOWNS AND VILLAGES SERVED BY		† PERCENTAGE TO SCHOOL-GOING AGE OF SCHOLARS IN	
				UNIVERSITY EDUCATION.		SCHOOL EDUCATION, GENERAL.			SCHOOL EDUCATION, SPECIAL.		TOTAL.								
Total Area in Square miles.	Number of Towns* and Villages.	Population.		Arts Colleges.	Professional Colleges.	Secondary Schools.	Primary Schools.	TOTAL.	Training Schools.	All other Special Schools.		Advanced.	Elementary.	TOTAL.		Public Institutions.	Public or Private Institutions.	Public Institutions.	Public or Private Institutions.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1,137,686	Towns* . 1,506 Villages 569,761 TOTAL . 571,357	Males . 130,302,188 Females 124,851,633 TOTAL 255,153,821	Institutions.																
			For Males .	138	44	6,279	116,650	122,029	616	5,638	129,365	2,763	34,870	37,633	166,998	4·4	3·4	..	..
			For Females	11	3	570	14,722	15,292	88	859	16,253	21	2,061	2,082	18,335	35·2	31·2	..	..
			TOTAL .	149	47	6,849	131,372	138,221	704	6,497	145,618	2,784	36,931	39,715	185,333	3·9	3·1	..	..
			Scholars.																
			Males .	38,836	7,948	991,704	4,609,405	5,601,109	14,606	160,703	5,823,202	57,698	534,915	592,613	6,415,995	..	..	20·8	32·8
			Females .	353	117	79,318	900,266	988,584	1,881	28,609	1,019,544	2,534	80,164	82,698	1,102,242	..	..	5·1	5·9
			TOTAL .	39,189	8,065	1,071,112	5,518,671	6,589,783	16,487	189,312	6,842,836	60,232	615,079	675,311	7,518,147	..	..	17·9	19·6

* All places containing 5,000 inhabitants or upwards and all municipalities whatever their population are entered as towns.
† The population of school-going age is taken at 15 per cent. of the whole population.

ABSTRACT STATEMENT OF EXPENDITURE ON PUBLIC INSTRUCTION IN THE

(*For details see*

—	TOTAL DIRECT EXPENDITURE ON PUBLIC INSTRUCTION.							TOTAL
	UNIVERSITY EDUCATION.		SCHOOL EDUCATION, GENERAL.		SCHOOL EDUCATION, SPECIAL.		Total.	University.
	Arts Colleges.	Colleges for Professional Training.	Secondary Schools.	Primary Schools.	Training Schools.	All other Special Schools.		
1	2	3	4	5	6	7	8	9
	R	R	R	R	R	R	R	R
1. Institutions. For Males	56,96,108	26,79,380	2,23,89,638	2,22,21,410	20,02,887	37,69,418	5,87,58,841	21,21,658
1. Institutions. For Females	78,162	23,936	33,21,372	33,80,544	4,50,117	2,39,557	74,93,688	
TOTAL .	57,74,270	27,03,316	2,57,11,010	2,56,01,954	24,53,004	40,08,975	6,62,52,529	21,21,658
2. (*a*) Percentages of Provincial expenditure included in columns 2—17 to total Provincial expenditure on Public Instruction.	5·95	5·49	15·17	15·81	5·33	5·13	52·88	2·16
(*b*) Percentages of Local Fund expenditure included in columns 2—17 to total Local Fund expenditure on Public Instruction.	·17	·04	8·98	60·84	1·86	·62	73·51	..
(*c*) Percentages of Municipal expenditure included in columns 2—17 to total Municipal expenditure on Public Instruction.	·84	·07	21·75	54·06	·36	2·77	79·85	..
(*d*) Percentages of total expenditure in columns 2—17 to total expenditure on Public Instruction.	5·76	2·70	25·65	25·54	2·45	4·00	60·10	2·12

TABLE II.

SEVERAL PROVINCES OF BRITISH INDIA FOR THE OFFICIAL YEAR 1913-14.

General Table IV.)

INDIRECT EXPENDITURE ON PUBLIC INSTRUCTION.							Total Expenditure on Public Instruction.	
Direction.	Inspection.	Scholarships.	Buildings.	Special Grants for furniture and apparatus.	Miscellaneous.	Total.		
10	11	12	13	14	15	16	17	18
R	R	R	R	R	R	R	R	
8,27,821	45,17,949	15,88,451	1,36,67,145	23,46,530	89,01,794	3,39,71,348	10,02,23,877	For Males / For Females — 1. Institutions.
8,27,821	45,17,949	15,88,451	1,36,67,145	23,46,530	89,01,794	3,39,71,348	10,02,23,877	TOTAL.
2·27	11·57	2·41	20·45	4·21	4·05	47·12	100	2. (*a*) Percentages of Provincial expenditure included in columns 2—17 to total Provincial expenditure on Public Instruction.
..	1·25	1·[illegible]	19·26	2·07	2·02	26·49	100	(*b*) Percentages of Local Fund expenditure included in columns 2—17 to total Local Fund expenditure on Public Instruction.
..	·34	1·03	15·33	1·18	2·27	20·15	100	(*c*) Percentages of Municipal expenditure included in columns 2—17 to total Municipal expenditure on Public Instruction.
·82	4·51	1·58	13·[illegible]		8·38	33·90	100	(*d*) Percentages of total expenditure in columns 2—17 to total expenditure on Public Instruction.

ABSTRACT STATEMENT OF EXPENDITURE ON PUBLIC INSTRUCTION IN THE

(*For details see*

	TOTAL DIRECT EXPENDITURE			
	UNIVERSITY EDUCATION.		SCHOOL EDUCATION, GENERAL.	
	Arts Colleges.	Colleges for Professional Training.	Secondary Schools.	Primary Schools.
1	2	3	4	5
	R a. p.	R a. p.	R a. p.	R a. p.
3. Average annual cost of educating each pupil in—				
Government Institutions . Cost to Provincial Revenues . .	174 2 8	287 2 4	21 6 5	9 5 10
Government Institutions . Cost to Local and Municipal Funds .	0 10 11	1 4 0	0 6 9	0 0 5
TOTAL COST .	258 10 5	373 4 4	43 7 8	9 15 1
Local Fund and Municipal Board Schools, Cost to Provincial Revenues . .	4 15 11	..	0 9 1	1 0 6
Local Fund and Municipal Board Schools, Cost to Local and Municipal Funds .	11 13 1	..	0 7 11	4 1 6
TOTAL COST .	100 1 1	78 7 1	13 2 3	5 15 9
Institutions in Native States. Cost to Native States Revenues . .	154 12 8	..	18 4 11	4 6 1
Institutions in Native States. Cost to Local and Municipal Funds .	..	..	.. 0 10 7	0 7 4
TOTAL COST .	195 15 11	..	. 30 7 3	5 4 9
Aided Institutions . Cost to Provincial Revenues . . .	33 0 10	123 14 9	6 7 4	0 10 3
Aided Institutions . Cost to Local and Municipal Funds . .	2 4 4	..	1 11 4	1 1 7
TOTAL COST .	139 7 2	226 0 5	28 0 0	4 3 3
Unaided Institutions . . . . . TOTAL COST .	71 4 4	82 8 11	19 0 2	2 6 2
All Institutions . . Cost to Provincial Revenues. . .	56 10 3	245 8 0	5 6 1	1 1 6
All Institutions . . Cost to Local and Municipal Funds .	1 7 5	1 0 11	2 1 5	2 1 7
TOTAL COST .	150 13 3	331 7 10	25 6 4	4 13 10

TABLE II—*contd.*

SEVERAL PROVINCES OF BRITISH INDIA FOR THE OFFICIAL YEAR 1913-14—*contd.*

General Table IV.)

ON PUBLIC INSTRUCTION.				
SCHOOL EDUCATION, SPECIAL.		TOTAL.		
Training Schools.	All other Special Schools.			
6	7	8	9	
R a. p.	R a. p.	R a. p.		
			3. Average annual cost of educating each pupil in—	
149 3 6	110 10 5	45 4 11	Cost to Provincial Revenues . . .	Government Institutions.
6 7 7	1 0 8	0 11 3	Cost to Local and Municipal Funds .	
158 2 10	129 7 9	63 15 0	TOTAL COST.	
4 0 7	8 7 0	1 5 7	Cost to Provincial Revenues . .	Local Fund and Municipal Board Schools.
95 2 11	35 14 3	4 6 11	*Cost to Local and Municipal Funds* .	
99 3 8	54 12 1	6 12 4	TOTAL COST.	
185 6 1	35 14 10	6 2 6	Cost to Native States Revenues . .	Institutions in Native States.
..	..	0 7 6	Cost to Local and Municipal Funds .	
192 15 2	37 12 11	8 2 4	TOTAL COST.	
106 9 8	3 9 2	2 2 3	Cost to Provincial Revenues . .	Aided Institutions.
0 8 0	1 13 8	1 3 9	Cost to Local and Municipal Funds .	
177 12 2	14 3 5	9 5 0	TOTAL COST.	
64 7 4	11 8 10	9 6 2	TOTAL COST	Unaided Institutions.
120 5 9	10 8 5	2 15 3	Cost to Provincial Revenues . .	All Institutions.
17 14 4	1 15 1	2 2 0	Cost to Local and Municipal Funds .	
151 13 7	22 9 1	10 2 4	TOTAL COST.	

Colleges, Schools and Scholars in the several Provinces of

Class and Institutions.	PUBLIC IN					
	Under Public					
	Managed by Government.				Managed by Local Funds	
	Number of Institutions.	Number of Scholars on the rolls on 31st March.	Average number on the rolls monthly during the year.	Average daily attendance.	Number of Institutions.	Number of Scholars on the rolls on 31st March.
1	2	3	4	5	6	7
University Education.						
Arts Colleges.						
English	25	8,611	8,408	7,653	4	485
Oriental	2	382	304	265	1	26
Colleges for Professional Training.						
Law	10	2,841	2,860	2,112	1	8
Medicine	4	1,676	1,667	1,633	..	..
Engineering	4	1,211	1,238	1,078	..	..
Teaching	9	654	668	620	..	..
Agriculture	3	156	194	165	..	..
Veterinary	1	172	176	174	..	..
Commercial	1	92	96	77	..	..
Total	59	15,795	15,670	13,786	6	519
School Education, General.						
Secondary Schools.						
For Boys—						
High Schools	220	72,166	70,323	61,612	56	20,913
Middle Schools { English	70	11,000	12,224	10,728	315	48,070
Middle Schools { Vernacular	70	7,205	6,545	5,775	877	121,884
For Girls—						
High Schools	18	2,070	2,016	2,301	..	132
Middle Schools { English	8	715	668	525	2	1,917
Middle Schools { Vernacular	26	2,502	2,466	1,886	14	
Total	421	97,557	95,142	[illegible],015	1,264	192,916
Primary Schools.						
For Boys	540	28,039	27,125	21,583	32,213	1,966,743
For Girls	579	45,692	43,366	31,271	2,360	121,593
Total	1,119	73,731	70,491	52,[illegible]	[illegible]	[illegible],336
School Education, Special.						
Training Schools for Masters	328	11,005	10,688	9,788	251	2,249
Training Schools for Mistresses	29	861	855	752	3	31
Schools of Art	5	1,288	1,270	1,047	..	..
Law Schools	1	14	16	16	..	..
Medical Schools	11	1,902	1,933	1,812	..	..
Engineering and Surveying Schools	7	575	619	565	..	..
Technical and Industrial Schools	26	1,575	1,520	1,290	40	2,354
Commercial Schools	3	350	410	353	1	101
Agricultural Schools	..	..	..	[illegible]	..	..
Reformatory Schools	7	1,202	1,201	[illegible]	[illegible]	..
Other Schools	77	5,709	5,584	4,408	8	384
Total	494	24,541	24,096	21,180	303	5,099
Total of Colleges and Schools of Public Instruction.	2,093	211,624	205,399	170,735	36,146	2,236,870

TABLE III.

British India for the official year 1913-14.

STITUTIONS.						
MANAGEMENT.						
and Municipal Boards.		Maintained by Native States.				CLASS OF INSTITUTIONS.
Average number on the rolls monthly during the year.	Average daily attendance.	Number of Institutions.	Number of Scholars on the rolls on 31st March.	Average number on the rolls monthly during the year.	Average daily attendance.	
8	9	10	11	12	13	1
						UNIVERSITY EDUCATION.
						Arts Colleges.
506	456	3	640	568	505	English.
26	22	..	..	..	..	Oriental.
						Colleges for Professional Training.
9	6	..	..	..	..	Law.
..	..	..	..	..	..	Medicine.
..	..	..	..	..	..	Engineering.
..	..	..	..	..	..	Teaching.
..	..	..	..	..	..	Agriculture.
..	..	..	..	..	..	Veterinary.
541	484	3	640	568	505	TOTAL.
						SCHOOL EDUCATION, GENERAL.
						Secondary Schools.
						For Boys—
20,688	18,659	36	9,660	9,201	7,771	High Schools.
45,869	40,596	140	9,527	8,925	7,589	English } Middle Schools.
117,688	95,686	35	1,319	1,208	999	Vernacular }
						For Girls—
..	..	1	308	278	203	High Schools.
123	80	3	128	118	91	English } Middle Schools.
1,805	1,419	..	..	..	..	Vernacular }
186,173	156,440	215	20,942	19,820	16,653	TOTAL
						Primary Schools.
1,877,889	1,477,521	3,110	192,394	186,186	140,647	For Boys.
114,730	84,229	292	23,660	23,064	15,389	For Girls.
1,992,619	[illegible]	3,411	216,054	209,250	156,036	TOTAL.
						SCHOOL EDUCATION, SPECIAL.
2,208	2,134	3	89	81	75	Training Schools for Masters.
33	28	1	43	37	35	Training Schools for Mistresses.
..	..	..	..	..	..	Schools of Art.
..	..	..	..	..	..	Law Schools.
..	..	..	..	..	..	Medical Schools.
..	..	..	..	..	..	Engineering and Surveying Schools.
2,173	1,742	6	405	393	250	Technical and Industrial Schools.
103	85	..	..	..	..	Commercial Schools.
..	..	..	..	..	..	Agricultural Schools.
..	..	..	..	..	..	Reformatory Schools.
330	253	19	519	459	305	Other Schools.
4,847	4,242	29	1,056	970	665	TOTAL.
2,184,180	1,722,916	3,638	233,692	230,608	173,859	TOTAL OF COLLEGES AND SCHOOLS OF PUBLIC INSTRUCTION.

Colleges, Schools and Scholars in the several Provinces

Class of Institutions.	Public Institutions. Under Private Management. Aided by Government, by Local Funds or Municipal Boards. Number of Institutions.	Number of Scholars on the rolls on 31st March.	Average number on the rolls monthly during the year.	Average daily attendance.	Unaided. Number of Institutions.	Number of Scholars on the rolls on 31st March.	Average number on the rolls monthly during the year	Average daily attendance.
1	14	15	16	17	18	19	20	21
University Education.								
Arts Colleges.								
English	68	18,612	18,283	16,290	25	9,172	8,950	7,588
Oriental	19	1,120	1,017	809	2	141	153	96
Colleges for Professional Training.								
Law	1	132	129	109	9	1,074	1,074	796
Medicine	..	..	..	..	..	..	..	..
Engineering	..	..	..	..	..	..	..	..
Teaching	3	47	43	42	1	2	2	2
Agriculture	..	..	..	..	..	..	..	..
Veterinary	..	..	..	..	..	..	..	..
Commercial	..	..	..	..	..	..	..	..
Total	91	19,911	19,472	17,259	37	10,389	10,188	8,482
School Education, General.								
Secondary Schools.								
For Boys— High Schools	673	231,346	224,447	193,779	364	132,074	122,822	102,261
Middle Schools English	1,422	103,813	101,254	134,334	718	78,155	72,405	58,103
Middle Schools Vernacular	1,223	90,193	88,606	83,525	71	5,269	4,972	4,046
For Girls— High Schools	130	17,095	16,633	14,458	8	930	891	781
Middle Schools English	184	17,906	17,158	14,996	13	710	654	574
Middle Schools Vernacular	160	17,030	16,373	14,064	3	176	183	154
Total	3,792	542,383	524,471	455,156	1,177	217,314	201,027	165,919
Primary Schools.								
For Boys	66,431	2,407,475	2,310,158	1,927,511	14,347	379,265	343,443	289,453
For Girls	9,797	313,093	298,182	238,737	1,694	40,717	37,474	30,380
Total	76,228	2,720,568	2,608,340	2,166,248	16,041	[illegible]	380,917	319,833
School Education, Special.								
Training Schools for Masters	29	1,231	1,266	1,168	[illegible]	[illegible]	121	112
Training Schools for Mistresses	50	818	824	779	[illegible]	[illegible]	41	40
Schools of Art	1	75	83	43	[illegible]	[illegible]	34	27
Law Schools	..	..	..	..	[illegible]	[illegible]	14	8
Medical Schools	3	212	219	205	10	1,[illegible]	305	1,206
Engineering and Surveying Schools	7	151	141	129	5	93	180	78
Technical and Industrial Schools	144	7,566	6,278	5,527	23	851	[illegible]	705
Commercial Schools	14	318	316	260	58	2,029	[illegible]	1,053
Agricultural Schools	1	11	11	11	..	..	[illegible]	..
Reformatory Schools	..	..	..	..	..	..	[illegible]	..
Other Schools	4,563	127,800	121,368	101,205	1,453	[illegible]	29,514	24,945
Total	4,812	138,182	130,506	109,327	1,563	36,921	33,366	28,174
Total of Colleges and Schools of Public Instruction.	84,923	3,421,044	3,282,789	2,747,990	18,818	634,606	626,398	522,408

Private Institutions.

1. Advanced Teaching—
   (a) Arabic or Persian
   (b) Sanskrit
   (c) Any other [illegible]
2. Elementary Teaching—
   (a) A vernacular only or mainly { For Boys / Girls
   (b) The [illegible] { " Boys / Girls
3. Other Schools not conforming to Departmental Standards. { " Boys / Girls

Total

Grand Total

TABLE III—*contd.*

of British India for the official year 1913-14—contd.

Grand Total of Institutions.	Grand Total of Scholars on the 31st of March.	Number of Scholars on the 31st of March learning			Number of girls in boys' schools.	Number of boys in girls' schools.	Class of Institutions.
		English.	A Classical Language.	A Vernacular Language.			
22	23	24	25	26	27	28	1
							UNIVERSITY EDUCATION.
							Arts Colleges.
125	37,520	37,157	20,195	19,776	155	..	English.
24	1,660	361	1,541	152	..	..	Oriental.
							Colleges for Professional Training.
21	4,055	3,434	..	..	1	..	Law.
4	1,676	811	..	..	69	..	Medicine.
4	1,211	700	..	..	..	..	Engineering.
13	703	621	32	182	6	..	Teaching.
3	156	17	..	..	..	..	Agriculture.
1	172	..	..	..	..	..	Veterinary.
1	92	..	..	..	..	..	Commercial.
196	47,254	43,101	21,768	20,110	231	..	TOTAL.
							SCHOOL EDUCATION, GENERAL.
							Secondary Schools.
							For Boys—
1,349	466,159	431,818	174,517	448,679	2,094	..	High Schools.
2,074	316,465	226,509	27,994	309,182	4,437	..	Middle Schools. English
2,256	225,060	1,205	36,787	226,201	18,066	..	Middle Schools. Vernacular
							For Girls—
157	21,312	18,088	4,419	12,461	..	2,321	High Schools.
210	19,591	15,105	910	11,480	..	2,570	Middle Schools. English
203	21,625	236	2,430	19,720	..	2,016	Middle Schools. Vernacular
6,849	1,071,112	693,951	247,096	1,027,702	24,597	7,807	TOTAL
							Primary Schools.
116,650	4,073,916	54,466	182,013	4,984,344	385,310	..	For Boys.
14,722	544,755	13,302	28,117	542,254	..	20,808	For Girls.
131,372	5,516,67[illegible]	[illegible]	10,130	5,526,598	385,310	20,808	TOTAL
							SCHOOL EDUCATION, SPECIAL.
616	14,696	923	2,642	14,062	90	..	Training Schools for Masters.
88	1,791	359	175	1,575	..	..	Training Schools for Mistresses.
10	1,307	109	..	504	39	..	Schools of Art.
1	28	14	..	..	..	..	Law Schools.
24	3,718	1,145	220	1,037	38	..	Medical Schools.
10	810	603	..	108	..	..	Engineering and Surveying Schools.
230	751	2,561	222	8,023	231	21	Technical and Industrial Schools.
70	008	904	..	336	76	3	Commercial Schools.
1	1	..	..	11	..	..	Agricultural Schools.
7	1,202	7	..	1,032	..	..	Reformatory Schools.
6,120	160,588	9,387	99,483	139,052	9,071	568	Other Schools.
7,201	205,709	16,162	102,751	168,310	9,545	592	TOTAL.
145,618	6,842,836	821,[illegible]	581,745	6,742,710	419,692	29,207	TOTAL OF COLLEGES AND SCHOOLS OF PUBLIC INSTRUCTION
							PRIVATE INSTITUTIONS.
							1. ADVANCED TEACHING—
1,521	37,278	818	36,006	3,550	1,126	5	(*a*) Arabic or Persian.
1,244	22,098	501	21,515	2,368	300	3	(*b*) Sanskrit.
16	856	113	670	177	28	129	(*c*) Any other Oriental Classic.
							2. ELEMENTARY TEACHING—
25,771	357,228	2,864	98,776	349,347	20,018	[illegible]	For Boys (*a*) Vernacular only or mainly.
394	11,414	21	4,851	11,116	[illegible]	854	,, Girls (*a*) Vernacular only or mainly.
6,057	146,450	[illegible]	134,870	14,098	28,136	[illegible]	,, Boys (*b*) The Koran only.
1,500	30,0[illegible]	[illegible]	30,166	998	[illegible]	4,830	,, Girls (*b*) The Koran only.
2,141	60,0[illegible]	20,571	8,624	54,731	2,588	[illegible]	,, Boys 3 OTHER SCHOOLS NOT CONFORMING TO DEPARTMENTAL STANDARDS.
68	[illegible]	502	502	3,430	..	104	,, Girls 3 OTHER SCHOOLS NOT CONFORMING TO DEPARTMENTAL STANDARDS.
39,715	[illegible]	25,[illegible]	332,010	439,815	42,396	6,025	TOTAL.
185,333	7,518,[illegible]	846,436	913,[illegible]	7,182,525	462,088	36,132	GRAND TOTAL.

Number of Scholars on 31st March 1914 in the several Provinces

—		Europeans and Anglo-Indians.	Indian Christians.	Hindus.		Muhammadans.	Buddhists.	Parsis.	Others.	Total.
				Brahmans.	Non-Brahmans.					
UNIVERSITY EDUCATION.										
Arts Colleges										
English	Male	166	966	13,380	17,668	3,788	358	442	399	37,167
	Female	86	100	50	75	4	1	29	8	353
Oriental	Male	..	1	1,099	102	456	..	..	11	1,669
	Female	..	..	..	..	..	..	..	..	..
Colleges for Professional Training.										
Law	Male	7	48	1,617	1,991	347	1	35	8	4,054
	Female	..	..	..	1	..	..	..	..	1
Medicine	Male	121	65	412	818	54	3	113	21	1,607
	Female	20	21	4	9	1	..	12	2	69
Engineering	Male	122	28	494	480	54	2	30	1	1,211
	Female	..	..	..	..	..	..	..	..	..
Teaching	Male	15	28	234	223	118	2	..	36	656
	Female	33	13	..	1	..	..	..	..	47
Commercial	Male	..	1	43	39	1	..	8	..	92
	Female	..	..	..	..	..	..	..	..	..
Agriculture	Male	2	8	51	59	21	..	8	7	156
	Female	..	..	..	..	..	..	..	..	..
Veterinary	Male	..	..	2	18	112	..	..	40	172
	Female	..	..	..	..	..	..	..	..	..
	Total	572	1,270	17,386	21,484	4,956	367	677	533	47,254
SCHOOL EDUCATION, GENERAL.										
Secondary Schools.										
For Boys.										
High Schools	Male	8,906	14,300	118,638	217,583	82,135	10,467	4,421	7,505	464,065
	Female	654	582	206	182	112	230	106	122	2,094
Middle Schools—										
English	Male	4,106	10,398	55,117	149,224	78,216	8,242	1,051	5,674	312,028
	Female	1,513	1,486	251	498	83	341	178	107	4,457
Vernacular	Male	13	3,800	26,892	87,054	30,800	45,199	4	5,022	207,894
	Female	3	1,253	154	560	393	15,602	..	41	18,006
For Girls.										
High Schools	Male	1,430	207	108	136	20	237	49	134	2,321
	Female	7,212	4,440	1,370	3,227	236	456	1,343	707	18,991
Middle Schools—										
English	Male	1,506	402	49	116	23	406	33	30	2,570
	Female	5,000	7,203	753	2,665	272	819	942	270	17,021
Vernacular	Male	3	145	21	101	83	2,563	..	..	2,916
	Female	13	2,500	2,253	8,555	1,501	3,100	..	787	18,709
	Total	30,449	46,780	205,812	470,501	202,370	87,240	7,537	20,399	1,071,112
Primary Schools.										
For Boys	Male	1,768	95,291	462,802	2,708,417	950,802	126,185	3,097	159,137	4,588,597
	Female	933	31,479	48,109	204,771	45,577	46,300	594	9,330	385,310
For Girls	Male	671	2,201	915	5,249	2,577	8,578	467	150	20,809
	Female	1,263	25,006	82,252	278,412	109,202	15,348	3,941	8,463	523,947
	Total	4,635	153,977	593,578	3,236,849	1,108,218	198,411	8,097	184,206	5,518,671

TABLE III-A.

of British India, classified according to sex, race, or creed.

—		Europeans and Anglo-Indians.	Indian Christians.	Hindus.		Muhammadans.	Buddhists.	Parsis.	Others.	Total.
				Brahmans.	Non-Brahmans.					
SCHOOL EDUCATION, SPECIAL.										
Training Schools	Male	6	1,311	4,041	6,030	2,663	312	..	243	14,606
	Female	171	897	270	332	157	22	10	22	1,881
Schools of Art	Male	8	89	299	643	240	3	40	31	1,353
	Female	17	4	1	3	..	..	17	2	44
Law Schools	Male	2	1	4	12	4	5	..	..	28
	Female	..	..	..	..	..	..	..	..	..
Medical Schools	Male	9	54	971	1,895	510	2	10	56	3,507
	Female	21	151	7	10	13	..	..	..	211
Engineering and Surveying Schools	Male	155	9	117	390	80	42	..	26	819
	Female	..	..	..	..	..	..	..	..	..
Technical and Industrial Schools	Male	297	1,839	825	2,399	2,058	14	150	367	9,546
	Female	1,103	1,460	31	393	73	130	1	14	3,205
Commercial Schools	Male	87	183	603	1,074	100	77	327	30	2,667
	Female	101	24	..	2	..	..	3	1	131
Agricultural Schools	Male	..	11	..	..	..	..	..	..	11
	Female	..	..	..	..	..	..	..	..	..
Reformatory Schools	Male	1	33	40	638	361	87	..	42	1,202
	Female	..	..	..	..	..	..	..	..	..
Other Schools	Male	55	271	17,788	13,741	106,394	3,084	91	146	141,570
	Female	51	153	164	950	23,578	110	9	3	25,018
	Total	2,084	6,490	25,251	20,518	136,027	3,888	658	983	205,700
Total of Colleges and Schools of Public Instruction.		37,740	208,532	842,027	3,803,352	1,452,480	280,915	17,509	186,221	6,842,836
PRIVATE INSTITUTIONS.										
Advanced Teaching.										
(a) Arabic or Persian	Male	..	4	108	928	34,801	..	30	..	35,871
	Female	..	..	..	5	1,402	..	..	..	1,407
(b) Sanskrit	Male	..	27	18,200	3,181	4	..	..	64	21,476
	Female	..	..	277	345	..	..	..	..	622
(c) Any other Oriental Classic	Male	..	..	18	272	10	..	45	..	351
	Female	..	..	..	352	..	..	153	..	505
Elementary Teaching.										
A Vernacular only or mainly—										
For Boys	Male	..	3,957	16,365	131,491	20,217	168,599	66	3,615	347,310
	Female	..	709	779	6,008	984	1,308	11	119	9,918
For Girls	Male	..	27	77	1,305	183	153	3	46	1,854
	Female	..	801	955	4,456	1,696	770	59	823	9,560
Elementary Teaching.										
The Koran only—										
For Boys	Male	..	..	588	670	116,037	..	..	28	117,323
	Female	..	..	..	27	28,109	..	..	..	28,136
For Girls	Male	..	..	..	..	4,830	..	..	..	4,830
	Female	..	..	120	491	25,269	..	..	270	26,150
Other Schools not conforming to Departmental Standards.										
For Boys	Male	..	1,783	8,207	37,886	12,477	1,607	34	1,410	63,404
	Female	..	354	183	1,681	321	27	18	4	2,588
For Girls	Male	33	..	..	2	4	65	..	..	104
	Female	36	540	522	1,758	610	284	..	47	3,812
	Total	69	8,208	46,300	193,018	240,969	172,903	419	6,426	675,311
	Grand Total	37,809	216,740	888,426	4,002,270	1,699,449	462,818	17,988	192,647	7,518,147

Number of European Colleges, Schools and Scholars in the several Provinces

PUBLIC

Class of Institutions.	Managed by Government.			
	Number of Institutions.	Number of Scholars on the rolls on 31st March.	Average number on the rolls monthly during the year.	Average daily attendance.
1	2	3	4	5
University Education.				
Arts Colleges.				
English	..	..	..	..
Colleges for Professional Training.				
Teaching	1	14	16	16
Total	1	14	16	16
School Education, General.				
Secondary Schools.				
For Boys—				
High Schools	5	1,005	1,061	982
Middle Schools, English	..	..	..	..
For Girls—				
High Schools	4	699	636	564
Middle Schools, English	1	44	35	32
Total	10	1,738	1,732	1,578
Primary Schools.				
For Boys	..	..	..	..
For Girls	..	..	..	..
Total	..	..	..	..
School Education, Special.				
Training Schools for Mistresses	1	12	19	19
Schools of Art	..	..	..	..
Engineering and Surveying Schools	1	6	5	5
Technical and Industrial Schools	..	..	..	..
Commercial Schools	..	..	..	..
Other Schools	..	..	..	..
Total	2	18	24	24
Total of Colleges and Schools of Public Instruction.	13	1,770	1,772	1,618

TABLE III-B.

of British India for the official year 1913-14.

INSTITUTIONS.										
UNDER PRIVATE MANAGEMENT.										
Aided by Government, by Local Funds or Municipal Boards.				Unaided.				Grand Total of Institutions.	Grand Total of Scholars on the 31st of March.	CLASS OF INSTITUTIONS.
Number of Institutions.	Number of Scholars on the rolls on 31st March.	Average number on the rolls monthly during the year.	Average daily attendance.	Number of Institutions.	Number of Scholars on the rolls on 31st March.	Average number on the rolls monthly during the year.	Average daily attendance.			
6	7	8	9	10	11	12	13	14	15	1
										UNIVERSITY EDUCATION.
										Arts Colleges.
2	18	19	17	4	32	29	27	6	50	English.
										Colleges for Professional Training.
1	32	28	28	..	..	..	..	2	46	Teaching.
3	50	47	45	4	32	29	27	8	96	TOTAL.
										SCHOOL EDUCATION, GENERAL.
										Secondary Schools.
										For Boys—
54	7,761	7,018	6,030	4	734	725	621	63	9,590	High Schools.
51	5,088	4,853	4,272	1	14	23	22	52	5,102	Middle Schools, English.
										For Girls—
71	8,676	8,504	7,672	2	114	131	123	77	9,389	High Schools.
79	6,423	6,233	5,484	1	71	66	63	81	6,538	Middle Schools, English.
255	27,948	27,268	24,367	8	933	945	829	273	30,619	TOTAL.
										Primary Schools.
44	2,557	2,351	1,999	2	27	23	19	46	2,584	For Boys.
36	1,861	1,807	1,525	2	71	59	54	38	1,932	For Girls.
80	4,418	4,158	3,524	4	98	82	73	84	4,516	TOTAL.
										SCHOOL EDUCATION, SPECIAL.
3	42	46	44	..	..	..	..	4	54	Training Schools for Mistresses.
..	..	..	..	1	5	6	5	1	5	Schools of Art.
4	96	97	87	3	30	31	29	8	132	Engineering and Surveying Schools.
17	1,398	63	580	..	..	..	..	17	1,398	Technical and Industrial Schools.
10	87	74	62	..	..	..	..	10	87	Commercial Schools.
5	102	95	84	..	..	..	..	5	102	Other Schools.
39	1,725	943	857	4	35	37	34	45	1,778	TOTAL.
377	34,141	32,416	28,793	20	1,098	1,093	963	410	37,009	TOTAL OF COLLEGES AND SCHOOLS OF PUBLIC INSTRUCTION.
PRIVATE INSTITUTIONS.										
Other Schools not conforming to Departmental Standards—										
For Boys								..	..	
For Girls								2	69	
							TOTAL	2	69	
							GRAND TOTAL	412	37,078	

Number of European Colleges, Schools, and Scholars in the several Provinces

Class of Institutions.	Number of Scholars on the 31st of March learning			Number of girls in boys' schools.	Number of boys in girls' schools.
	English.	A Classical Language.	A Vernacular Language.		
1	16	17	18	19	20
University Education.					
Arts Colleges.					
English	50	28	..	..	..
Colleges for Professional Training.					
Teaching	46	32	17	..	..
Total	96	60	17	..	..
School Education, General.					
Secondary Schools.					
For Boys—					
High Schools	9,589	3,667	5,162	671	..
Middle Schools, English	5,059	305	1,932	1,518	..
For Girls—					
High Schools	9,389	2,925	1,315	..	1,611
Middle Schools, English	6,538	517	1,287	..	1,518
Total	30,575	7,414	9,696	2,189	3,129
Primary Schools					
For Boys	2,584	171	514	941	..
For Girls	1,932	269	102	..	694
Total	4,516	440	616	941	694
School Education, Special.					
Training Schools for Mistresses	54	..	..	..	..
Schools of Art	..	..	..	..	..
Engineering and Surveying Schools	132	..	16	..	..
Technical and Industrial Schools	1,158	..	15	10	3
Commercial Schools	69	..	..	..	3
Other Schools	102	..	..	..	6
Total	1,515	..	31	10	12
Total of Colleges and Schools of Public Instruction.	36,702	7,914	10,360	3,140	3,835
Private Institutions.					
Other Schools not conforming to Departmental Standards—					
For Boys	..	..	..	..	..
For Girls	69	..	..	..	33
Total	69	..	..	..	33
GRAND TOTAL	36,771	7,914	10,360	3,140	3,868

TABLE III-B—*contd.*

of British India for the year 1913-14—contd.

CLASSIFICATION OF SCHOLARS ON THE 31ST MARCH ACCORDING TO RACE OR CREED.								CLASS OF INSTITUTIONS.
Europeans and Anglo-Indians.	Indian Christians.	Hindus.		Muhammadans.	Buddhists.	Parsis.	Others.	
		Brahmans.	Non-Brahmans.					
21	22	23	24	25	26	27	28	1
								UNIVERSITY EDUCATION.
								Arts Colleges.
48	1	1	..	..	..	..	..	English.
								Colleges for Professional Training.
46	..	..	..	..	..	..	..	Teaching.
94	1	1	..	..	..	..	..	TOTAL.
								SCHOOL EDUCATION, GENERAL.
								Secondary Schools.
								For Boys—
8,939	120	39	81	97	70	136	108	High Schools.
4,759	91	30	5	27	15	20	146	Middle Schools, English.
								For Girls—
8,479	236	115	19	31	90	112	307	High Schools.
6,209	86	63	1	22	21	103	33	Middle Schools, English.
28,386	533	256	106	177	196	371	594	TOTAL.
								Primary Schools.
2,427	62	17	2	3	21	44	8	For Boys.
1,832	31	15	4	..	2	42	6	For Girls.
4,259	93	32	6	3	23	86	14	TOTAL.
								SCHOOL EDUCATION, SPECIAL.
54	..	..	..	..	..	..	..	Training Schools for Mistresses.
5	..	..	..	..	..	..	..	Schools of Art.
132	..	..	..	..	..	..	..	Engineering and Surveying Schools.
1,323	35	7	12	..	..	12	19	Technical and Industrial Schools.
87	..	..	..	..	..	..	..	Commercial Schools.
87	0	2	..	..	..	3	1	Other Schools.
1,688	41	9	12	..	..	5	20	TOTAL.
34,427	671	298	124	180	219	462	628	TOTAL OF COLLEGES AND SCHOOLS OF PUBLIC INSTRUCTION.
								PRIVATE INSTITUTIONS.
								Other Schools not conforming to Departmental Standards—
69	..	..	..	..	..	..	..	For Boys.
	..	..	..	..	..	..	..	For Girls.
69	..	..	..	..	..	..	..	TOTAL.
34,496	671	298	124	180	219	462	628	GRAND TOTAL.

Expenditure (in rupees) on Public Instruction in the several Provinces

Objects of Expenditure	Public						
	Under Public						
	Managed by Government.						
	Provincial Revenues.	Local Funds.	Municipal Funds.	Fees.	Subscriptions.	Endowments and other sources	Total.
1	2	3	4	5	6	7	8
	R	R	R	R	R	R	R
University Education.							
Arts Colleges.							
English	15,07,842	..	6,000	7,04,848	1,551	28,400	22,48,641
Oriental	19,943	..	..	..	..	300	20,243
Colleges for Professional Training.							
Law	28,501	..	..	2,16,003	..	1,039	2,46,025
Medicine	5,54,366	4,276	2,507	2,01,504	..	5,737	7,68,450
Engineering	7,74,150	..	..	67,596	..	13,760	8,55,506
Teaching	3,82,808	1,691	138	100	..	5,911	3,90,738
Agriculture	1,02,410	..	..	12,036	..	..	2,05,055
Veterinary	47,489	..	..	8,357	..	44,094	99,940
Commercial	505	..	..	7,686	..	..	8,191
Total	35,08,503	5,967	8,645	12,18,832	1,551	1,00,141	49,43,689
School Education, General							
Secondary Schools.							
For Boys—							
High Schools	14,56,743	2,957	32,051	17,36,102	4,020	44,327	32,97,100
Middle Schools { English	2,17,488	13	3,381	1,76,494	1,025	5,515	4,07,316
Middle Schools { Vernacular	1,09,424	609	..	14,108	104	..	1,24,335
For Girls—							
High Schools	1,93,086	..	..	48,095	300	19,473	2,60,944
Middle Schools { English	25,189	..	..	5,726	188	10	31,113
Middle Schools { Vernacular	34,367	..	72	1,160	324	..	35,923
Total	20,36,297	3,579	35,504	19,81,681	6,060	72,125	41,36,746
Primary Schools.							
For Boys	2,65,547	430	96	20,114	26	7,659	2,93,872
For Girls	3,94,680	657	518	7,079	1,485	1,887	4,06,905
Total	6,60,227	1,087	614	27,792	1,511	9,546	7,00,777
School Education, Special.							
Training Schools for Masters	15,00,850	56,652	5,824	19,513	407	6,169	15,89,415
Training Schools for Mistresses	2,11,568	8,378	3,849	813	1,445	10,078	2,36,431
Schools of Art	2,13,094	..	..	21,020	..	11,935	2,46,958
Law Schools	3,001	..	..	2,000	..	..	6,000
Medical Schools	3,10,129	3,564	..	40,221	..	7,044	3,67,958
Engineering and Surveying Schools	1,86,102	..	..	20,906	501	2,000	2,10,508
Technical and Industrial Schools	2,25,151	4,493	..	7,575	906	18,681	2,56,806
Commercial Schools	28,956	..	..	11,548	..	80	40,584
Agricultural Schools	1,725	792	..	..	..	..	2,517
Reformatory Schools	2,32,815	..	1,348	..	..	9,793	2,43,956
Other Schools	1,80,105	60	2,800	40,172	..	18,037	2,50,174
Total	31,01,446	73,939	13,821	1,72,786	3,250	86,016	34,51,267
Buildings	43,02,345	66	..	882	3,500	29,212	43,36,005
Furniture and Apparatus (special grants only)	5,09,889	370	..	8,702	42,363	24,516	5,85,840
Total	48,12,234	436	..	9,584	45,863	53,728	49,21,845
Total Expenditure on Public Instruction	1,41,18,707	85,008	59,484	34,10,725	58,344	3,21,556	1,80,54,324

TABLE IV.

of British India for the official year 1913-14.

INSTITUTIONS.							
MANAGEMENT.							
Managed by Local Funds and Municipal Boards.							OBJECTS OF EXPENDITURE
Provincial Revenues.	Local Funds.	Municipal Funds.	Fees.	Subscriptions.	Endowments and other sources.	TOTAL.	
9	10	11	12	13	14	15	
R	R	R	R	R	R	R	UNIVERSITY EDUCATION.
							Arts Colleges.
2,657	..	4	42,283	..	2,011	46,955	English.
..	6,282	..	..	..	..	6,282	Oriental.
							Colleges for Professional Training.
..	..	..	706	..	..	706	Law.
..	..	..	..	..	..	..	Medicine.
..	..	..	..	..	..	..	Engineering.
..	..	..	..	..	..	..	Teaching.
..	..	..	..	..	..	..	Agriculture.
..	..	..	..	..	..	..	Veterinary.
..	..	..	..	..	..	..	Commercial.
2,657	6,282	4	42,989	..	2,011	53,943	TOTAL
							SCHOOL EDUCATION, GENERAL
							Secondary Schools.
68,520	12,537	45,852	4,20,815	..	3,059	5,45,792	For Boys— High Schools.
40,502	17,814	1,75,783	4,74,100	10,342	5,087	8,03,241	English } Middle Schools.
	73,096	73,244	2,10,361	6,021	1,441	10,64,163	Vernacular }
							For Girls— High Schools.
1,033	..	4,541	88	..	..	5,662	English } Middle Schools.
203	5,710	20,806	244	..	61	27,114	Vernacular }
1,05,250	3,83,777	3,20,226	11,05,608	16,363	9,648	24,45,062	TOTAL
							Primary Schools.
20,30,052	61,66,270	12,51,080	8,88,248	33,545	28,070	1,09,98,763	For Boys.
1,71,179	4,14,395	3,29,097	5,333	2,268	2,185	9,25,357	For Girls.
28,01,831	65,80,665	15,81,080	8,93,581	35,813	31,164	1,19,24,140	TOTAL.
							SCHOOL EDUCATION, SPECIAL.
7,500	2,09,818	2,134	20	..	2	2,19,510	Training Schools for Masters.
1,541	36	1,283	..	..	..	2,860	Training Schools for Mistresses.
..	..	..	..	..	..	..	Schools of Art.
..	..	..	..	..	..	..	Law Schools.
..	..	..	..	..	..	..	Medical Schools.
..	..	..	..	..	..	..	Engineering and Surveying Schools.
17,302	64,800	24,004	5,654	318	19,976	1,32,054	Technical and Industrial Schools.
849	..	840	979	..	..	2,668	Commercial Schools.
..	..	..	..	..	..	..	Agricultural Schools.
..	..	..	..	..	..	..	Reformatory Schools.
3,811	207	2,092	215	25	..	7,070	Other Schools.
31,033	2,74,981	31,853	6,874	343	19,978	3,65,062	TOTAL.
1,14,087	26,50,410	5,42,413	207	48,201	10,083	33,65,503	*Buildings.*
72,641	2,59,742	34,063	1,266	6,496	1,524	3,75,632	*Furniture and Apparatus* (special grants only).
1,86,728	29,09,161	5,77,376	1,473	54,790	11,607	37,41,135	TOTAL.
31,27,499	1,06,59,866	25,10,545	20,50,615	1,07,309	74,408	1,85,30,242	TOTAL EXPENDITURE ON PUBLIC INSTRUCTION.

Expenditure (in rupees) on Public Instruction in the several Provinces

PUBLIC

Objects of Expenditure.	Under Public Management.						
	Managed by Native States.						
	Native States Revenues	Local Funds in Native States.	Municipal Funds raised in Native States.	Fees	Subscriptions	Endowments and other sources.	Total
1	16	17	18	19	20	21	22
	R	R	R	R	R	R	R
University Education.							
Arts Colleges							
English	87,021	..	..	22,041	..	1,363	1,11,325
Oriental	..	..	..	..	..	..	..
Colleges for Professional Training.							
Law	..	..	..	..	..	..	..
Medicine	..	..	..	..	..	..	..
Engineering	..	..	..	..	..	..	..
Teaching	..	..	..	..	..	..	..
Agriculture	..	..	..	..	..	..	..
Veterinary	..	..	..	..	..	..	..
Total	87,021	..	..	22,041	..	1,363	1,11,325
School Education, General							
Secondary Schools.							
For Boys—							
High Schools	2,14,145	3,228	..	1,14,532	2,185	32,803	3,67,283
Middle Schools { English	1,29,590	2,121	6,739	55,706	19,940	3,609	2,16,765
Middle Schools { Vernacular	9,534	531	480	418	10	..	10,973
For Girls—							
High Schools	4,602	..	..	..	68	132	4,802
Middle Schools { English	4,564	..	..	..	..	58	4,622
Middle Schools { Vernacular	..	..	..	..	..	..	..
Total	3,62,825	5,880	7,219	1,70,716	22,260	34,602	6,03,535
Primary Schools							
For Boys	7,02,017	82,480	5,822	52,102	15,500	24,531	9,72,421
For Girls	1,23,659	5,574	1,389	41	2,430	1,724	2,14,817
Total	9,10,576	88,063	7,211	52,203	17,930	26,255	11,18,238
School Education, Special.							
Training Schools for Masters	14,169	..	..	276	..	618	14,443
Training Schools for Mistresses	7,707	..	..	..	..	..	8,325
Schools of Art	..	..	..	..	..	..	..
Law Schools	..	..	..	..	..	..	..
Medical Schools	..	..	..	..	..	..	..
Engineering and Surveying Schools	..	..	..	..	..	..	..
Technical and Industrial Schools	23,135	..	..	21	..	422	23,578
Commercial Schools	..	..	..	..	..	..	..
Agricultural Schools	..	..	..	..	..	..	..
Reformatory Schools	..	..	..	..	..	..	..
Other Schools	7,476	..	..	371	156	634	8,634
Total	52,486	..	..	667	153	1,074	54,080
Buildings	1,62,377	140	..	441	5,766	..	1,68,602
Furniture and Apparatus (special grants only)	20,037	251	1,616	1,603	1,586	27	25,169
Total	1,82,414	400	1,616	2,052	7,372	27	1,93,861
Total Expenditure on Public Instruction	16,02,222	91,343	16,016	2,47,079	47,638	64,011	20,71,939

TABLE IV—*contd.*

of British India for the official year 1913-14—contd.

INSTITUTIONS—*contd.*							
UNDER PRIVATE MANAGEMENT.							
Aided by Government or by Local or Municipal Boards.							OBJECTS OF EXPENDITURE
Provincial Revenues.	Local Funds.	Municipal Funds.	Fees.	Subscriptions.	Endowments and other sources.	TOTAL.	
23	24	25	26	27	28	29	1
R	R	R	R	R	R	R	
							UNIVERSITY EDUCATION.
							Arts Colleges.
6,00,512	18,050	25,223	12,62,607	1,05,474	6,18,214	26,30,080	English.
37,439	90	410	338	11,191	11,827	61,301	Oriental.
							Colleges for Professional Training.
4,000	..	..	9,728	..	..	13,728	Law.
..	..	..	..	..	..	..	Medicine.
..	..	..	..	..	..	..	Engineering.
17,315	..	..	2,614	..	5,316	25,245	Teaching.
..	..	..	..	..	..	..	Agriculture.
..	..	..	..	..	..	..	Veterinary.
6,59,266	18,140	25,633	12,75,287	1,16,665	6,35,357	27,30,354	TOTAL.
							SCHOOL EDUCATION, GENERAL.
							Secondary Schools.
							For Boys—
15,91,078	16,250	1,63,053	46,80,924	4,13,001	9,21,269	77,80,384	High Schools.
6,25,497	1,06,336	1,42,177	16,23,190	3,23,840	4,09,010	33,85,050	English } Middle Schools.
1,58,360	2,02,057	77,395	1,65,811	32,316	20,880	6,46,834	Vernacular }
							For Girls—
6,06,774	..	19,853	6,26,890	1,20,326	3,51,141	17,24,084	High Schools.
3,38,375	783	25,302	1,79,632	1,24,533	2,49,145	9,17,770	English } Middle Schools.
67,367	20,712	34,283	17,502	43,006	40,765	2,24,325	Vernacular }
33,88,357	4,35,137	7,02,093	72,88,949	10,58,012	20,53,119	1,49,86,247	TOTAL.
							Primary Schools.
18,54,472	20,80,043	3,28,809	28,70,705	5,27,597	14,75,730	91,37,356	For Boys.
4,[illegible]	3,36,337	1,25,736	1,46,984	2,40,152	5,35,008	18,22,122	For Girls.
22,03,377	24,16,380	4,54,545	30,11,689	7,67,749	20,10,738	1,09,59,478	TOTAL.
							SCHOOL EDUCATION, SPECIAL.
1,15,027	594	34	516	11,102	47,055	1,74,333	Training Schools for Masters.
1,07,778	72	348	11,844	25,074	51,229	1,97,245	Training Schools for Mistresses.
1,800	..	350	1,352	..	7,759	11,261	Schools of Arts.
..	..	..	..	..	..	..	Law Schools.
19,609	400	2,700	1,428	14,372	4,950	43,449	Medical Schools.
4,562	656	150	6,371	1,047	2,894	15,074	Engineering and Surveying Schools.
2,65,260	16,014	33,158	46,008	70,868	5,11,370	9,43,074	Technical and Industrial Schools.
15,347	..	..	16,012	3,723	11,354	46,436	Commercial Schools.
..	..	..	05	..	2,480	2,735	Agricultural Schools.
..	..	..	..	..	..	..	Reformatory Schools.
1,52,231	1,48,818	35,329	2,02,379	1,25,579	97,845	7,61,581	Other Schools.
6,81,770	1,67,248	72,069	2,85,905	2,52,670	7,36,036	21,06,688	TOTAL.
29,13,066	1,87,244	35,064	52,524	7,01,910	11,[illegible]747	50,06,555	*Buildings.*
9,27,[illegible]	46,056	0,208	21,061	1,02,237	1,36,000	12,42,244	*Furniture and Apparatus* (special grants only).
38,40,589	2,33,300	44,332	73,585	8,04,147	12,52,846	63,38,799	TOTAL.
1,08,68,3[illegible]	32,70,221	10,58,012	1,10,35,505	30,80,843	66,88,090	3,09,11,506	TOTAL EXPENDITURE ON PUBLIC INSTRUCTION.

Expenditure (in rupees) on Public Instruction in the several Provinces

Objects of Expenditure	PUBLIC INSTITUTIONS—*concld.* Under Private Management. *Unaided.* Fees.	Subscriptions.	Endowments and other sources.	Total.	TOTAL Provincial Revenues.	Local Funds
1	30	31	32	33	34	35
	R	R	R	R	R	R
University Education *Arts Colleges*						
English	4,32,724	39,633	1,68,092	6,40,449	21,11,011	18,0[illegible]
Oriental	..	..	8,094	8,094	57,352	6,[illegible]
Colleges for Professional Training.						
Law	65,646	12,787	9,668	88,101	32,891	..
Medicine	..	..	..	..	5,54,366	4,[illegible]
Engineering	..	..	..	..	7,74,150	..
Teaching	240	..	491	731	4,00,213	1,[illegible]
Agriculture	..	..	..	..	1,02,419	..
Veterinary	..	..	..	..	47,499	..
Commercial	..	..	..	..	205	..
TOTAL	4,98,610	52,420	1,87,245	7,38,275	41,70,426	30,395
School Education, General. *Secondary Schools*						
For Boys—						
High Schools	23,17,607	2,16,182	3,60,296	28,90,085	31,12,850	30,753
Middle Schools { English	5,01,588	1,91,735	1,31,433	8,27,756	6,83,350	2,94,239
Middle Schools { Vernacular	16,318	10,673	9,671	36,662	2,67,790	9,75,[illegible]
For Girls—						
High Schools	44,645	598	19,556	64,799	7,09,540	733
Middle Schools { English	5,030	1,067	10,170	16,317	3,01,597	26,432
Middle Schools { Vernacular	..	1,890	1,011	2,901	1,02,047	[illegible]
TOTAL	23,85,238	4,22,145	5,31,137	38,38,520	65,30,504	13,27,[illegible]
Primary Schools.						
For Boys	4,75,509	1,12,912	2,29,527	8,17,978	47,52,712	52,46,[illegible]
For Girls	7,175	32,605	51,563	91,343	10,09,701	7,51,[illegible]
TOTAL	4,82,684	1,45,517	2,81,090	9,09,321	57,62,[illegible]	1,59,[illegible]
School Education, Special.						
Training Schools for Masters	..	1,099	3,498	5,166	16,23,377	2,67,004
Training Schools for Mistresses	425	754	4,017	5,256	3,20,557	5,445
Schools of Art	675	..	1,920	2,595	2,15,701	..
Law Schools	478	..	..	478	3,911	..
Medical Schools	42,030	360	4,400	46,090	3,35,72[illegible]	2,0[illegible]
Engineering and Surveying Schools	2,674	..	5,920	8,594	1,90,72[illegible]	95[illegible]
Technical and Industrial Schools	1,534	5,038	78,293	85,5[illegible]	6,07,719	[illegible]
Commercial Schools	63,923	1,520	9,529	[illegible]	47,152	702
Agricultural Schools	..	..	..	..	[illegible]	..
Reformatory Schools	..	..	..	..	2,72,[illegible]	..
Other Schools	47,012	57,617	64,505	1,69,165	3,36,210	1,44,[illegible]
TOTAL	1,33,811	67,036	1,72,205	3,73,0[illegible]	[illegible]	[illegible]
[illegible]	21,[illegible]	1,19,347	5,59,780	7,00,[illegible]	71,[illegible]	24,19,[illegible]
[illegible]	11,411	14,051	92,150	1,17,613	15,[illegible]	[illegible]
TOTAL	[illegible]	1,33,[illegible]	6,51,930	[illegible]	[illegible]	21,[illegible]
TOTAL	4,[illegible]	8,21,516	18,23,[illegible]	[illegible]	2,8[illegible]	1,40,[illegible]
[illegible]	..	..	..	..	7,97,[illegible]	..
[illegible]	..	..	..	..	8,37,[illegible]	[illegible]
[illegible]	..	..	..	..	42,17,[illegible]	[illegible]
[illegible]	..	..	..	..	2,47,[illegible]	7,37[illegible]
[illegible]	..	..	..	..	[illegible]	[illegible]
[illegible]	..	..	..	..	[illegible]	[illegible]
[illegible]	..	..	..	..	[illegible]	[illegible]
[illegible]	..	..	..	..	3,14,[illegible]	[illegible]
[illegible]	..	..	..	..	[illegible]	[illegible]
[illegible]	..	..	..	..	[illegible]	[illegible]
[illegible]	..	..	..	..	[illegible]	[illegible]
[illegible]	..	..	..	..	[illegible]	[illegible]
[illegible]	..	..	..	..	[illegible]	[illegible]
TOTAL	..	..	..	..	[illegible]	[illegible]
GRAND TOTAL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE IV—*concld.*

of British India for the official year 1913-14—concld.

EXPENDITURE FROM					
Municipal Funds.	Fees.	ALL OTHER SOURCES.		Grand Total.	OBJECTS OF EXPENDITURE
		Private	Public.		
36	37	38	39	40	41
R	R	R	R	R	
					UNIVERSITY EDUCATION.
					Arts Colleges.
31,227	24,64,503	9,02,530	1,50,120	56,77,450	English.
410	338	31,238	1,074	90,820	Oriental.
					Colleges for Professional Training
..	2,02,175	9,878	14,516	3,49,460	Law.
2,507	2,01,564	2,732	3,005	7,68,450	Medicine
..	67,596	13,760	..	8,56,606	Engineering
138	2,954	11,718	..	4,10,714	Teaching
..	12,876	..	..	2,05,055	Agriculture.
..	8,357	..	44,091	99,040	Veterinary.
..	7,086	..	..	8,191	Commercial.
34,282	30,57,809	9,71,856	2,12,818	84,77,586	TOTAL.
					SCHOOL EDUCATION, GENERAL
					Secondary Schools.
					For Boys—
2,42,356	92,69,980	18,99,090	3,10,734	1,48,66,653	High Schools
3,21,341	28,76,228	11,44,707	1,60,152	56,40,028	English } Middle Schools
1,50,030	7,07,016	82,287	9,428	18,82,057	Vernacular }
					For Girls—
19,853	7,19,020	4,82,800	32,477	20,55,019	High Schools.
29,845	1,00,526	1,70,910	28,825	9,75,484	English } Middle Schools.
55,161	18,912	87,451	206	2,00,260	Vernacular }
8,19,193	1,34,72,282	40,58,144	5,42,012	2,57,11,010	TOTAL
					Primary Schools
15,70,038	43,05,738	24,32,872	9,02,347	2,22,21,410	For Boys.
4,56,251	1,61,211	6,61,079	1,40,845	33,80,544	For Girls.
20,80,202	44,67,949	32,93,951	10,43,192	2,56,01,954	TOTAL
					SCHOOL EDUCATION, SPECIAL
7,992	20,320	68,471	15,613	20,02,887	Training Schools for Masters.
5,480	12,482	91,119	8,663	4,50,117	Training Schools for Mistresses.
350	23,056	19,094	1,920	2,60,814	Schools of Art.
..	2,187	..	..	6,478	Law Schools
2,700	83,699	30,483	1,633	4,58,207	Medical Schools.
150	29,951	13,301	..	2,35,136	Engineering and Surveying Schools.
58,062	70,890	7,06,524	23,135	14,42,833	Technical and Industrial Schools.
840	57,464	26,215	..	1,59,075	Commercial Schools
..	63	2,480	..	5,252	Agricultural Schools.
1,348	..	9,701	..	2,43,956	Reformatory Schools.
40,821	2,99,070	3,59,031	12,806	11,06,624	Other Schools
1,17,743	6,20,133	13,29,853	63,800	64,61,070	TOTAL.
5,77,477	25,280	24,50,614	2,58,828	1,36,67,145	*Buildings*
14,306	44,981	3,92,511	25,402	23,40,530	*Furniture and Apparatus*
6,21,783	1,10,361	28,43,125	2,84,230	1,60,13,075	TOTAL
30,20,210	2,16,97,534	1,24,90,929	21,46,952	5,22,66,204	TOTAL
	9,54,005	2,82,316	98,000	21,21,058	University.
..	..	..	..	8,27,821	Direction
13,027	..	1,590	1,01,529	45,17,949	Inspection.
					Scholarships held in—
1,347	4,224	1,50,300	9,395	4,23,424	Arts Colleges
332	..	9,331	420	52,660	Medical Colleges.
452	3,470	20,008	163	1,01,694	Other Professional Colleges.
10,457	4,621	91,578	29,656	9,07,816	Secondary Schools
7,075	110	10,785	10,573	1,50,729	Primary Schools
563	..	14,186	6,295	63,247	Medical Schools.
3,352	..	13,001	1,730	82,123	Technical and Industrial Schools
1,554	..	10,090	577	47,258	Other Special Schools
85,567	30,99,668	28,92,530	1,47,726	89,01,794	Miscellaneous.
1,37,326	40,66,104	84,93,818	1,05,960	3,79,57,673	TOTAL
37,66,536	2,66,63,728	1,59,95,747	25,52,912	10,02,23,877	TOTAL EXPENDITURE ON PUBLIC INSTRUCTION.

Expenditure (in rupees) on Public Instruction for Europeans

Objects of Expenditure.	PUBLIC			
	Under Public Management.			
	Managed by Government.			
	Provincial Revenues.	Fees.	Endowments and other sources.	Total.
1	2	3	4	5
	R	R	R	R
University Education.				
Arts Colleges.				
English	..	..	..	..
Colleges for Professional Training.				
Teaching	22,864	..	..	22,864
Total	22,864	..	..	22,864
School Education, General.				
Secondary Schools.				
For Boys—				
High Schools	76,055	46,127	17,875	1,40,057
Middle Schools, English	..	..	..	..
For Girls—				
High Schools	30,317	28,914	15,722	74,953
Middle Schools, English	4,831	5,246	..	10,077
Total	1,11,803	80,287	33,597	2,25,687
Primary Schools.				
For Boys	..	..	..	..
For Girls	..	..	..	..
Total	..	..	..	..
School Education, Special.				
Training Schools for Masters	9,358	..	..	9,358
Training Schools for Mistresses	..	..	..	..
Engineering and Surveying Schools	5,560	1,020	..	6,580
Technical and Industrial Schools	..	..	..	..
Commercial Schools	..	..	..	..
Other Schools	8,280	..	..	8,280
Total	23,198	1,020	..	24,218
Total Direct Expenditure	1,57,865	81,307	33,597	2,72,769
Buildings	80,641	..	2,075	82,716
Furniture and Apparatus (special grants only)	4,732	..	14,895	19,627
Total	85,373	..	16,970	1,02,343
Total Expenditure on Public Instruction	2,43,238	81,307	50,567	3,75,112

TABLE IV-A.

in the several Provinces of British India for the official year 1913-14.

INSTITUTIONS.							
UNDER PRIVATE MANAGEMENT.							OBJECTS OF EXPENDITURE.
Aided by Government or by Local or Municipal Boards.							
Provincial Revenues.	District Funds.	Municipal Funds.	Fees.	Subscriptions.	Endowments and other sources.	TOTAL.	
6	7	8	9	10	11	12	1
R	R	R	R	R	R	R	
							UNIVERSITY EDUCATION.
							Arts Colleges.
4,308	..	..	2,766	700	3,960	11,734	English.
							Colleges for Professional Training.
11,100	..	..	2,334	..	4,476	17,910	Teaching.
15,408	..	..	5,100	700	8,436	29,644	TOTAL.
							SCHOOL EDUCATION, GENERAL.
							Secondary Schools.
							For Boys—
5,14,748	..	2,107	4,32,081	45,049	2,45,825	12,39,810	High Schools.
1,97,469	435	7,833	79,165	35,611	1,38,048	4,58,561	Middle Schools, English.
							For Girls—
4,46,596	..	1,414	4,00,598	50,545	1,96,294	11,85,447	High Schools.
2,25,810	390	9,720	97,768	46,744	96,836	4,77,307	Middle Schools, English.
13,84,662	825	21,074	10,99,612	1,77,949	6,77,003	33,61,125	TOTAL.
							Primary Schools.
95,923	..	2,062	28,200	10,145	32,796	1,37,426	For Boys.
43,683	..	1,540	25,020	7,105	16,008	91,298	For Girls.
1,08,006	..	3,602	53,102	17,250	48,804	2,31,724	TOTAL.
							SCHOOL EDUCATION, SPECIAL.
16,357	..	..	2,656	700	6,361	26,074	Training Schools for Masters.
222	..	..	..	..	..	222	Training Schools for Mistresses.
850	..	..	3,480	706	2,520	7,556	Engineering and Surveying Schools.
26,415	..	..	16,517	1,078	5,948	50,858	Technical and Industrial Schools.
4,382	..	..	5,270	3,401	4,029	17,085	Commercial Schools.
9,275	..	..	6,590	485	6,036	22,186	Other Schools.
57,301	..	..	34,513	7,273	24,894	1,23,081	TOTAL.
15,66,277	825	24,676	11,92,327	2,03,172	7,50,197	37,46,474	TOTAL DIRECT EXPENDITURE.
6,00,220	..	14,000	30,343	1,76,840	3,34,690	11,56,093	*Buildings.*
1,22,883	..	..	14,684	21,016	26,013	1,85,525	*Furniture and Apparatus* (special grants only).
7,23,103	..	14,000	45,027	1,98,785	3,60,703	13,41,618	TOTAL.
22,89,380	825	38,676	12,37,354	4,01,957	11,10,900	50,88,092	TOTAL EXPENDITURE ON PUBLIC INSTRUCTION.

Expenditure (in rupees) on Public Instruction for Europeans

Objects of Expenditure	PUBLIC INSTITUTIONS—*contd.*				TOTAL
	UNDER PRIVATE MANAGEMENT				
	Unaided				
	Fees.	Subscriptions.	Endowment and other sources	TOTAL.	Provincial Revenues
1	13	14	15	16	17
	R	R	R	R	R
UNIVERSITY EDUCATION.					
Arts Colleges					
English	.	..	..	..	4,303
Colleges for Professional Training					
Teaching	..	..	..	..	33 961
TOTAL	..	..	..	..	38,272
SCHOOL EDUCATION, GENERAL					
Secondary Schools					
For Boys—					
High Schools	59,038	14,028	5,709	79,074	5,92,003
Middle Schools, English	1,039	..	..	1,039	1,07,469
For Girls—					
High Schools	24,023	..	1,200	25,223	4,76,913
Middle Schools, English	2,856	200	1,400	4,456	2,30,680
TOTAL	88,756	14,228	8,309	1,11,202	14,87,065
Primary Schools.					
For Boys	1,175	541	..	1,716	65,223
For Girls	1,062	480	1,540	3,082	43,683
TOTAL	2,237	1,021	1,540	4,798	1,08,906
SCHOOL EDUCATION, SPECIAL					
Training Schools for Masters	.	..	..	..	25,715
Training Schools for Mistresses	.	..	..	..	222
Engineering and Surveying Schools	922	..	4,318	5,140	6,410
Technical and Industrial Schools	..	..	..	..	26,415
Commercial Schools	..	..	..	..	4,382
Other Schools	..	..	..	..	17,355
TOTAL	922	..	4,318	5,140	80,499
TOTAL DIRECT EXPENDITURE	91,915	15,249	14,166	1,21,230	17,24,742
Buildings	2,212	1,000	12,237	15,449	6,01,713
Furniture and Apparatus	2,346	1,000	4,523	7,869	1,20,309
TOTAL	4,558	2,000	16,760	..	8,21,022
Inspection	..	..	..	..	28,551
Scholarships held in—					
Arts Colleges	..	..	..	..	10,417
Medical Colleges	..	..	..	..	710
Other Professional Colleges	..	..	..	..	6 644
Secondary Schools	..	..	..	..	42,578
Primary Schools	..	..	..	..	14,130
Medical Schools	..	..	..	..	930
Technical and Industrial Schools	..	..	..	..	3,08,123
Miscellaneous	..	..	..	..	
TOTAL	..	..	..	..	7,19,113
TOTAL INDIRECT EXPENDITURE	..	..	..	..	..
TOTAL EXPENDITURE ON PUBLIC INSTRUCTION	96,473	7,249	30,926	1,14,548	32,64,577

TABLE IV-A—*contd.*

in the several Provinces of British India for the official year 1913-14—contd.

EXPENDITURE FROM						OBJECTS OF EXPENDITURE.
			ALL OTHER SOURCES.		Grand Total.	
District Funds.	Municipal Funds.	Fees.	Private.	Public.		
18	19	20	21	22	23	1
R	R	R	R	R	R	UNIVERSITY EDUCATION.
						Arts Colleges.
..	..	2,766	3,060	700	11,734	English.
						Colleges for Professional Training.
..	..	2,334	4,476	..	40,774	Teaching.
..	..	5,100	8,436	700	52,508	TOTAL
						SCHOOL EDUCATION, GENERAL.
						Secondary Schools.
						For Boys—
	2,107	5,38,146	2,22,007	1,04,078	14,60,141	High Schools.
.. 435	7,833	81,101	1,17,714	55,045	4,60,500	Middle Schools, English.
						For Girls—
	1,414	5,43,535	1,81,912	81,840	12,85,623	High Schools.
.. 390	9,720	1,05,870	94,794	50,386	4,91,840	Middle Schools, English.
825	21,074	12,68,655	6,17,327	2,93,158	36,98,104	TOTAL.
						Primary Schools.
..	2,062	28,375	42,868	614	1,30,142	For Boys.
..	1,540	26,964	24,335	858	97,380	For Girls.
..	3,602	55,339	67,203	1,472	2,36,522	TOTAL.
						SCHOOL EDUCATION, SPECIAL.
..	..	2,650	6,361	700	35,432	Training Schools for Masters.
..	..	..	..	..	222	Training Schools for Mistresses.
..	..	5,425	7,444	..	10,276	Engineering and Surveying Schools.
..	..	16,617	7,250	676	50,858	Technical and Industrial Schools.
..	..	5,270	3,048	3,485	17,085	Commercial Schools.
..	..	6,500	1,317	5,204	30,466	Other Schools.
..	..	36,455	26,320	10,065	1,53,339	TOTAL.
825	24,676	13,60,549	7,10,286	3,05,395	41,40,473	TOTAL DIRECT EXPENDITURE.
						Buildings.
..	14,000	32,555	3,75,638	1,40,352	12,54,238	*Furniture and Apparatus.*
..	..	17,030	59,799	6,883	2,13,021	
..	14,000	49,585	4,35,437	1,47,235	14,67,270	TOTAL.
..	..	..	..	..	28,551	Inspection.
						Scholarships held in—
..	..	1,529	109	4,564	25,409	Arts Colleges.
..	..	..	..	..	240	Medical Colleges.
..	..	..	..	..	6,044	Other Professional Colleges.
..	..	..	1,873	..	50,451	Secondary Schools.
..	..	..	5,436	..	10,566	Primary Schools.
..	..	..	..	..	..	Medical Schools.
..	..	..	..	..	2,030	Technical and Industrial Schools.
..	..	12,81,215	8,28,621	1,32,022	28,47,611	Miscellaneous.
..	760	12,82,535	8,36,038	1,77,486	30,75,932	TOTAL.
..	..	..	..	..	..	TOTAL INDIRECT EXPENDITURE.
825	30,436	26,07,690	10,90,701	5,90,116	85,83,681	TOTAL EXPENDITURE ON PUBLIC INSTRUCTION.

Stages for instruction of pupils in public schools for general

Class of Schools	Number of Schools.	Number of pupils on the rolls on 31st March.	HIGH STAGE. Comprising all pupils who have passed beyond the Lower Secondary (Middle) Stage, but have not passed the Matriculation Examination.		
			Boys.	Girls.	Total
1	2	3	4	5	6
SECONDARY SCHOOLS					
For Boys					
Government — English	298	83,021	29,471	2	29,473
Government — Vernacular	71	7,440	2	..	2
Local Fund — English	202	36,654	1,037	1	1,038
Local Fund — Vernacular	842	115,370	..	..	..
Municipal — English	160	32,329	4,996	1	4,997
Municipal — Vernacular	35	6,503	..	..	..
Native States — English	176	19,187	6,277	4	6,281
Native States — Vernacular	15	1,319	..	..	..
Aided — English	2,084	309,032	76,299	167	76,466
Aided — Vernacular	1,234	91,320	43	..	43
Unaided — English	1,082	210,229	48,954	94	49,048
Unaided — Vernacular	71	5,209	..	..	..
Total	6,279	1,009,584	167,079	269	168,248
For Girls.					
Government — English	26	3,094	..	506	506
Government — Vernacular	26	2,502	..	..	..
Local Fund — English	..	..	..	..	..
Local Fund — Vernacular	4	372	..	..	..
Municipal — English	2	132	..	..	..
Municipal — Vernacular	10	1,545	..	..	..
Native States — English	4	436	..	11	11
Native States — Vernacular	..	..	..	..	..
Aided — English	314	35,001	6	2,376	2,382
Aided — Vernacular	100	17,030	..	..	..
Unaided — English	21	1,640	3	245	248
Unaided — Vernacular	3	178	..	..	..
Total	570	62,528	9	3,138	3,147
Total Secondary Schools	6,849	1,071,112	167,088	3,407	171,395
PRIMARY SCHOOLS					
For Boys.					
Government	540	28,030	..	..	..
Local Fund	30,442	1,763,615	..	..	..
Municipal	1,771	203,128	..	..	..
Native States	3,119	102,394	..	..	..
Aided	66,431	2,407,475	..	..	..
Unaided	14,347	379,205	..	..	..
Total	116,650	4,973,916	..	..	..
For Girls.					
Government	579	45,692	..	..	..
Local Fund	1,815	77,184	..	..	..
Municipal	545	44,409	..	..	..
Native States	292	23,660	..	..	..
Aided	9,797	313,003	..	..	..
Unaided	1,694	40,717	..	..	..
Total	14,722	544,755	..	..	..
Total Primary Schools	131,372	5,518,671	..	..	..
GRAND TOTAL	138,221	6,589,783	167,088	3,407	171,395

TABLE V.

education in British India at the end of the official year 1913-14.

MIDDLE STAGE. Comprising all pupils who have passed beyond the Upper Primary Stage, but have not passed beyond the Lower Secondary (Middle) Stage.			Total Secondary Stage.			Class of Schools.
Boys.	Girls.	Total.	Boys.	Girls.	Total.	
7	8	9	10	11	12	1
						SECONDARY SCHOOLS.
						For Boys.
34,062	32	34,094	63,433	34	63,567	English } Government.
1,415	42	1,457	1,417	42	1,459	Vernacular }
12,787	27	12,814	14,724	28	14,752	English } Local Fund.
38,060	11	38,071	38,060	11	38,071	Vernacular }
15,035	10	15,045	20,031	11	20,042	English } Municipal.
1,223	..	1,223	1,223	..	1,223	Vernacular }
11,014	19	11,033	17,301	23	17,324	English } Native States.
277	..	277	277	..	277	Vernacular }
1,26,640	1,135	1,27,775	2,02,939	1,302	2,04,241	English } Aided.
10,129	452	10 581	10,172	452	10,624	Vernacular }
57,670	100	57,770	1,06,624	194	1,06,818	English } Unaided.
1,020	2	1,022	1,020	2	1,022	Vernacular }
3,00,332	1,830	3,11,162	477,811	2,099	479,410	Total
						For Girls
..	731	731	..	1,237	1,237	English } Government.
..	102	102	..	192	192	Vernacular }
..	..	..	..	..	..	English } Local Fund.
..	26	26	..	26	26	Vernacular }
..	11	11	..	11	11	English } Municipal.
..	174	174	..	174	174	Vernacular }
..	425	425	..	436	436	English } Native States.
..	..	..	..	..	..	Vernacular }
198	7,214	7,412	204	9,500	9,704	English } Aided.
182	944	1,126	182	944	1,126	Vernacular }
7	500	507	10	745	755	English } Unaided.
..	15	15	..	15	15	Vernacular }
387	10,232	10,619	396	13,370	13,766	Total
309,719	12,062	321,781	477,707	15,469	493,176	Total Secondary Schools.
						PRIMARY SCHOOLS.
						For Boys.
186	..	186	186	..	186	Government.
2,409	10	2,419	2,409	10	2,419	Local Fund.
116	1	117	116	1	117	Municipal
16	..	16	16	..	16	Native States.
3,156	133	3,289	3,156	133	3,289	Aided.
66	..	66	66	..	66	Unaided.
5,949	144	6,093	5,949	144	6,093	Total
						For Girls.
..	727	727	..	727	727	Government.
..	28	28	..	28	28	Local Fund.
..	34	34	..	34	34	Municipal.
..	4	4	..	4	4	Native States.
14	1,669	1,683	14	1,669	1,683	Aided.
..	86	86	..	86	86	Unaided.
14	2,548	2,562	14	2,548	2,562	Total.
5,963	2,692	8,655	5,963	2,692	8,655	Total Primary Schools.
315,682	14,754	330,436	483,670	18,161	501,831	GRAND TOTAL.

Stages for instruction of pupils in public schools for general

Class of Schools		UPPER PRIMARY STAGE			LOWER PRIMARY					
		Comprising all Pupils who have passed beyond the Lower Primary Stage, but have not passed beyond the Upper Primary Stage			Comprising all Pupils who have not passed beyond					
					Reading Printed Books.			Not Reading Printed Books		
		Boys.	Girls.	Total.	Boys	Girls	Total.	Boys.	Girls	Total
1		13	14	15	16	17	18	19	20	21
SECONDARY SCHOOLS.										
For Boys.										
Government	English	13,694	43	13,737	6,368	84	6,452	165	..	165
	Vernacular	1,483	104	1,587	2,266	569	3,535	850	..	850
Local Fund	English	10,443	17	10,460	10,092	149	10,241	584	17	601
	Vernacular	25,095	68	25,163	41,603	415	42,018	9,820	304	10,124
Municipal	English	5,499	3	5,472	6,530	17	6,547	263	5	268
	Vernacular	1,033	..	1,033	3,375	13	3,388	846	18	864
Native States	English	1,073	2	1,075	618	5	623	173	2	175
	Vernacular	289	1	290	513	1	514	233	5	238
Aided	English	90,257	1,241	91,498	94,371	2,644	97,015	6,048	230	6,278
	Vernacular	16,095	2,090	18,185	43,132	14,033	57,165	5,313	33	5,346
Unaided	English	52,101	85	52,186	47,426	251	47,677	3,514	34	3,548
	Vernacular	1,250	1	1,251	2,208	8	2,216	774	6	780
	Total	218,282	3,655	221,937	259,902	18,189	277,991	28,592	654	29,246
For Girls										
Government	English	11	485	496	59	1,416	1,475	5	481	486
	Vernacular	3	319	322	60	1,370	1,430	5	553	558
Local Fund	English	..	..	..	..	..	..	..	18	18
	Vernacular	..	44	44	..	284	284	..	50	50
Municipal	English	..	21	21	..	50	50	..	53	53
	Vernacular	..	422	422	..	896	896	..	..	..
Native States	English	..	..	..	..	..	..	..	..	..
	Vernacular	..	..	..	..	..	..	..	..	..
Aided	English	733	5,656	6,389	3,334	13,098	16,431	464	1,903	2,367
	Vernacular	453	2,060	2,513	2,176	8,942	11,118	37	2,236	2,273
Unaided	English	23	247	270	23	491	514	5	97	101
	Vernacular	..	17	17	..	100	100	..	44	44
	Total	1,223	9,271	10,494	5,651	26,647	32,298	527	5,433	5,970
Total Secondary Schools		219,505	12 926	232,431	265,453	44,836	310,289	29,129	6,087	35,216
PRIMARY SCHOOLS										
For Boys										
Government		4,491	21	4,512	15,666	631	16,297	6,548	556	7,104
Local Fund		170,766	1,078	181,444	1,058,378	53,450	1,111,828	411,489	53,475	464,964
Municipal		32,432	146	32,578	119,196	4,371	123,567	42,512	4,574	47,086
Native States		32,174	326	32,500	95,98	3,528	99,511	51,650	5,717	57,367
Aided		89,235	5,551	94,786	1,430,629	140,375	1,570,004	656,401	82,073	738,474
Unaided		4,019	77	4,096	197,480	10,401	207,890	149,590	17,623	167,213
	Total	342,117	7,799	349,916	2,917,281	212,716	3,129,997	1,323,250	164,060	1,487,910
For Girls										
Government		2	2,621	2,623	346	28,283	28,623	26	12,693	12,719
Local Fund		2	4,098	4,100	309	46,616	46 925	169	25,992	26,161
Municipal		2	3,320	3,322	131	27,447	27,578	189	13,286	13,475
Native States		..	2,450	2,459	13	11,463	11,476	36	9,685	9 721
Aided		1,352	10,777	12,129	14,225	158,642	172,867	3,023	124,701	127,724
Unaided		10	520	530	427	14,567	14,994	531	24,574	25,107
	Total	1,371	23,790	25,163	15,445	287,018	302,463	3,976	210,591	214,567
Total Primary Schools		343,490	31,589	375,079	2,932,726	499,734	3,432,460	1,327,226	375,251	1,702,477
Grand Total		562,995	44,515	607,510	3,198,179	544,570	3,742,749	1,356,355	381,338	1,737,693

TABLE V—*contd.*

education in British India at the end of the official year 1913-14—contd.

STAGE			TOTAL PRIMARY STAGE.			GRAND TOTAL			CLASS OF SCHOOLS
THE LOWER PRIMARY STAGE									
Total.									
Boys.	Girls.	TOTAL.	Boys.	Girls.	Total.	Boys.	Girls	Total	
22	23	24	25	26	27	28	29	30	1
									SECONDARY SCHOOLS.
									FOR BOYS.
6,533	84	6,617	20,227	127	20,354	83,760	161	83,921	English } Government.
3,825	500	4,331	5,308	673	5,981	6,725	715	7,440	Vernacular }
11,276	166	11,442	21,719	183	21,902	36,443	211	36,654	English } Local Fund
51,123	719	52,142	76,518	787	77,305	114,578	798	115,376	Vernacular }
6,793	22	6,815	12,262	25	12,287	32,293	30	32,320	English } Municipal.
4,221	31	4,252	5,254	31	5,285	6,477	31	6,508	Vernacular }
791	7	798	1,864	9	1,873	19,155	32	19,187	English } Native States.
746	6	752	1,097	7	1,012	1,312	7	1,319	Vernacular }
100,410	2,971	103,201	100,070	4,115	104,701	303,615	5,417	309,032	English } Aided.
48,145	14,066	62,511	64,510	16,150	80,606	74,712	16,608	91,320	Vernacular }
50,040	285	51,225	100,041	370	100,411	209,665	561	210,226	English } Unaided.
2,982	14	2,996	4,232	15	4,247	5,252	17	5,269	Vernacular }
288,304	18,843	307,237	566,676	22,108	529,174	983,987	24,567	1,008,584	TOTAL.
									FOR GIRLS.
64	1,897	1,961	75	2,382	2,457	75	3,610	3 691	English } Government.
65	1,023	1,088	68	2,242	2,310	68	2,434	2,502	Vernacular }
..	..	..	..	..	..	..	..	..	English } Local Fund.
..	302	302	..	346	346	..	372	372	Vernacular }
..	100	100	..	121	121	..	132	132	English } Municipal.
..	949	949	..	1,771	1,771	..	1,545	1,545	Vernacular }
..	..	..	..	..	..	..	436	436	English } Native States
..	..	..	..	..	..	..	..	..	Vernacular }
3,817	15,001	18,818	4,550	20,057	25,207	4,754	30,247	35,001	English } Aided.
2,215	11,178	13,391	2,666	13,238	15,904	2,848	14,182	17,030	Vernacular }
29	580	615	53	833	895	62	1,578	1,640	English } Unaided.
..	144	144	..	161	161	..	176	176	Vernacular }
6,189	32,080	38,268	7,411	41,351	48,762	7,807	54,721	62,528	TOTAL.
294,582	50,923	345,505	574,087	63,949	577,036	991,794	79,318	1,071,112	TOTAL SECONDARY SCHOOLS.
									PRIMARY SCHOOLS.
									FOR BOYS
22,154	1,187	23,341	20,615	1,208	27,823	26,871	1,208	28,030	Government
1,472,887	106,885	1,579,752	1,662,673	108,503	1,761,196	1,655,042	108,573	1,763,615	Local Fund
161,708	8,725	170,433	191,140	8,871	200,011	191,250	8,872	200,128	Municipal
150,613	9,245	159,858	182,807	9,771	192,578	182,823	9,571	192,394	Native States
2,080,000	227,010	2,307,010	2,175,525	225,661	2,401,186	2,178,481	226,091	2,407,475	Aided
347,079	24,024	371,103	757,098	28,101	379,199	351,164	28,101	379,265	Unaided.
4,240,531	377,376	4,617,907	4,582,049	385,175	4,967,823	4,588,597	385,310	3,973,916	TOTAL.
									FOR GIRLS.
366	41,976	42,342	308	44,597	44,965	268	47,324	45,592	Government
478	77,578	71 056	485	76,671	77,156	485	76,999	77,184	Local Fund.
320	40,733	41,053	322	44,054	44,376	329	44,087	44,409	Municipal.
49	21,148	21,197	49	23,607	23,656	49	23,611	23,660	Native States
17,248	282,033	299,281	18,600	292 810	311,410	18,614	294,479	313,093	Aided
960	39,141	40,101	970	39,661	40,631	970	39,747	40,717	Unaided
19,421	497,609	517,030	20,734	521,399	542,193	20,805	623,047	644,755	TOTAL.
4,259,952	874,985	5,134,937	4,603,442	906,574	5,510,016	4,609,405	909,260	5,518,671	TOTAL PRIMARY SCHOOLS.
4,554,534	925,909	5,480,442	5,117,529	970,423	6,088,052	5,601,199	988,584	6,589,783	GRAND TOTAL

Results of the prescribed examinations in the several

Nature of Examinations.	Number of Institutions sending Examinees.				Number of Examinees.					Number	
	Institutions under Public Management.	Aided Institutions.	Other Institutions.	Total.	Institutions under Public Management.	Aided Institutions.	Other Institutions.	Private Students.	Total.	Institutions under Public Management.	Aided Institutions.
Arts Colleges											
Doctor of Science	1	..	..	1	1	..	..	..	1	..	..
Master of Arts	9	14	2	25	181	213	13	431	838	117	124
Master of Science	4	3	1	8	53	15	3	53	124	41	10
Bachelor of Arts (Honours), Preliminary English Examination	1	2	..	3	73	41	..	..	114	68	36
Bachelor of Arts	28	47	18	93	1,260	2,184	1,408	1,047	5,989	712	1,549
Bachelor of Science	14	14	6	34	289	221	148	12	670	174	117
Bachelor of Science (Honours)	..	1	2	3	..	1	24	1,111	1,136	..	1
First B.A.	..	..	..	..	..	..	..	..	..	..	..
First B.S.	..	..	..	..	..	..	..	..	..	..	..
Intermediate Examination in Arts	32	65	32	129	2,188	5,310	2,975	1,043	11,516	1,163	2,434
Intermediate Examination in Science	14	16	8	38	365	152	486	46	1,049	298	229
Previous Examination	7	4	..	11	212	313	..	97	622	50	95
Oriental Colleges.											
Master of Oriental Learning	..	..	..	..	..	..	..	..	..	..	..
Bachelor of Oriental Learning	..	..	..	..	..	..	..	..	..	..	..
First Arts Oriental Faculty	..	..	..	..	..	..	..	..	..	..	..
Honours in Sanskrit	1	2	15	18	138	27	58	147	370	104	7
Honours in Arabic	..	1	..	1	..	13	..	18	31	..	2
Honours in Persian	..	1	..	1	..	5	..	32	37	..	1
Honours in Gurmukhi	..	1	..	1	..	2	..	26	28	..	..
Honours in Punjabi	..	..	..	..	..	..	..	..	..	53	44
High Proficiency in Sanskrit	1	12	187	200	117	84	723	115	1,039	9	4
High Proficiency in Arabic	..	3	..	3	..	6	..	3	9	..	..
High Proficiency in Persian	..	1	..	1	..	1	..	3	4	..	2
High Proficiency in Punjabi	..	1	..	1	..	4	..	12	16	..	..
High Proficiency in Hindi	..	..	..	..	..	..	..	..	..	..	..
High Proficiency in Urdu	..	..	..	..	..	..	..	5	5	..	..
Proficiency in Sanskrit	1	12	238	251	24	81	842	160	1,107	8	23
Proficiency in Arabic	..	2	5	7	..	15	10	15	40	..	5
Proficiency in Persian	..	..	..	..	..	..	..	7	7	..	..
Proficiency in Hindi	..	..	..	..	..	..	..	5	5	..	..
Proficiency in Urdu	..	..	..	..	..	..	..	23	23	..	..
Proficiency in Punjabi	..	..	..	..	..	..	..	..	..	..	..
Additional Examination in English for Oriental Titles.	..	..	..	..	..	..	..	..	..	..	..
Colleges for Professional Training.											
Law.											
Doctor of Law	..	..	..	..	..	..	..	20	21	..	..
Master of Law	..	1	..	1	1	..	1	..	2	..	..
Honours in Law	..	..	..	..	..	..	..	..	..	..	..
Bachelor of Law	6	1	10	17	941	166	564	319	1,990	536	111
First LL.B	1	..	..	1	413	..	..	..	413	106	..
First Examination in Law	1	..	2	3	255	..	148	276	709	144	..
Special Test Examination in Law	..	..	..	..	..	..	..	..	..	..	..
Intermediate Examination in Law	..	..	..	..	..	..	..	..	..	..	..
Licentiate Examination in Law	..	..	..	..	..	..	..	..	..	..	..
First Certificate Examination in Law	..	..	..	..	..	..	..	..	..	..	..
Preliminary Examination in Law	..	..	..	..	..	..	..	..	..	..	..
Medicine.											
M.S.	..	..	..	..	..	..	..	..	..	..	..
M.D.	2	2	..	4	6	..	..	..	6	3	..
M.B. (a)	3	2	..	5	82	..	..	..	82	51	..
Second Professional Examination for M.B., B.S.	3	2	..	5	138	..	..	..	138	92	..
First Professional Examination for M.B., B.S.	3	2	..	5	113	..	..	..	113	69	..
Honours in Medicine	1	1	..	2	1	..	..	..	1	1	..
Intermediate M.B., B.S. Examination	3	2	..	5	150	..	..	..	150	62	..
L.M.S. (b)	3	2	..	5	253	..	..	..	253	178	..
First M.B. (c)	3	2	..	5	187	..	..	..	187	105	..
First L.M.S. (d)	3	2	..	5	20	..	..	..	20	13	11
Additional Test in Chemistry	1	1	2	4	191	20	58	..	269	124	..
Preliminary Scientific M.B.	1	1	..	2	50	..	..	..	50	101	..
L.M.S.	..	1	5	6	..	122	44	..	166	12	80
Preliminary Scientific L.M.S.	2	1	..	3	12	..	..	..	12	2	23
Bachelor of Hygiene	..	1	..	1	..	2	..	..	2	..	..
Second Preliminary Science and First M.B.	1	1	..	2	..	..	..	..	..	..	..
Special Examination for Licentiate	..	..	..	..	..	..	..	..	..	..	..

(a) Final or Third M.B. and C.M. Examination in Madras, and Second M.B. Examination in Bengal.
(b) Second L.M.S. Examination in Bengal.

Results of the prescribed examinations in the several

Nature of Examinations.		Number of Institutions sending Examinees. Institutions under Public Management.	Aided Institutions.	Other Institutions.	Total.	Numbers of Examinees. Institutions under Public Management.	Aided Institutions.	Other Institutions.	Private Students.	Total.	Numbe[rs] Institutions under Public Management.	Aided Institutions.
Colleges for Professional Training—contd												
Engineering.												
M.O.E.		..	..	..	..	..	..	..	..	..	..	..
B.C.E.		3	..	..	3	40	..	..	..	40	20	..
L.C.E.		3	..	..	3	65	..	..	..	65	24	..
First L.C.E.		..	..	..	..	..	..	..	..	..	..	..
Examination in Art drawing		..	..	..	..	..	..	..	..	..	..	..
First Examination in Engineering		1	..	..	1	56	..	..	..	56	45	..
Roorkee College Examinations—												
Civil Engineer		3	..	..	3	137	..	..	..	137	92	..
Electrical Engineer		..	..	..	..	..	..	..	..	..	..	..
Upper Subordinate		1	..	..	1	38	..	..	..	38	37	..
Lower Subordinate		1	..	..	1	53	..	..	..	53	53	..
Teaching		7	4	1	12	274	30	2	35	(a)586	339	35
Agriculture												
L. Ag.		2	..	..	2	33	..	..	..	33	27	..
Second L. Ag.		1	..	..	1	20	..	..	..	20	17	..
First L. Ag.		1	..	..	1	34	..	..	..	34	30	..
Veterinary		1	..	..	1	57	..	..	..	57	52	..
Commercial		..	1	..	1	..	4	..	..	4	..	1
Schools for General Education.												
Matriculation Examination	Boys	235	462	314	1,011	6,038	8,514	6,507	1,571	22,080	3,847	4,754
	Girls	8	42	7	57	56	180	33	35	304	33	114
School Final	Boys	120	229	26	375	2,730	5,669	530	32	8,961	1,601	[illegible]
	Girls	..	..	..	..	..	..	..	..	..	..	..
High School Examination for Europeans.	Boys	3	30	1	34	19	222	6	3	250	13	114
	Girls	2	28	1	31	9	114	1	..	124	0	56
High School Scholarship Examination.	Boys	59	14	1	74	522	95	6	1	624	249	49
	Girls	..	3	..	3	..	10	..	..	10	..	4
Elementary Certificate Examination.	Boys	..	8	..	8	..	82	..	..	82	..	46
	Girl	..	13	..	13	..	75	..	..	75	..	51
Public Service Certificate Examination		1,235	76	124	1,435	5,300	350	651	1,283	7,584	2,696	205
Cambridge Preliminary Examination	Boys	..	1	..	1	..	[illegible]	..	..	20	..	13
Cambridge Senior Examination	Boys	..	4	2	6	..	37	30	..	67	..	27
	Girls	..	6	..	6	..	25	..	..	25	..	20
Cambridge Junior Examination	Boys	1	8	2	11	10	94	28	..	132	8	69
	Girls	1	11	..	12	11	52	..	..	63	8	43
Middle School Examination	Boys	1,056	2,536	817	4,409	22,178	29,805	[illegible]	9,186	67,0[illegible]	14,678	20,528
	Girls	38	237	12	287	229	1,700	[illegible]	87	2,000	459	1,229
Upper Primary Examination	Boys	11,875	[illegible]	1,027	22,813	107,657	82,418	20,123	[illegible]	210,323	69,535	57,379
	Girls	871	[illegible]	[illegible]	740	[illegible]	6,305	21	[illegible]	10,091	2,481	4,628
Lower Primary Examination	Boys	12,329	32,132	2,298	46,759	[illegible]	259,050	19,477	[illegible]	371,883	159,293	180,455
	Girls	926	2,846	128	3,000	[illegible]	28,158	249	[illegible]	[illegible]	5,081	20,001
Schools for Special Instruction												
Training School Examination for Masters.	Upper	31	6	..	37	1,217	67	[illegible]	300	1,584	1,034	46
	Lower	386	30	..	416	5,576	190	372	427	6,574	4,037	317
Training School Examination for Mistresses	Upper	15	24	1	40	[illegible]	216	4	18	478	208	171
	Lower	17	22	2	41	175	157	[illegible]	18	307	140	103
Teachers' Examination for outside Training School	students	28	1,2[illegible]	..	1,245	26	1,417	[illegible]	[illegible]	[illegible]	[illegible]	220
Schools of Art Examination		220	[illegible]	[illegible]	[illegible]	15,282	5,644	2,521	477	(c)17,255	5,723	3,808
Medical Examination		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]52	150	[illegible]
Examination in Engineering		24	4	1	29	617	37	24	[illegible]	758	[illegible]	83
Examination in Surveying		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	311
Industrial School Examination		[illegible]	11[illegible]	[illegible]	186	150	346	231	[illegible]	1,177	701	75
Commercial School Examination		[illegible]	2	[illegible]	15	126	73	76	[illegible]	295	64	[illegible]
Agricultural School Examination		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26	1,723
Sanskrit Title Examination		6	[illegible]	101	[illegible]	[illegible]	[illegible]	637	66	4,509	304	74
Madrassa Central Examination		4	6	[illegible]	[illegible]	[illegible]	123	16	[illegible]	577	[illegible]	[illegible]
Madrassa Maktab Examination		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	919
Other Schools Examination		85	[illegible]	[illegible]	633	5,007	[illegible]	[illegible]	375	6,146	1,028	[illegible]

(a) Includes 136 [illegible] up for the Licentiate in [illegible] Examination from the
(b) Inc[illegible] passed in the Licentiate in teaching Examination from the
(c) In[illegible] students sent up for the Schools of Art and Industrial
(d) Includes 1,028 and 318 students pa[illegible] the Schools of Art and Industrial
(e) Includes 80 stude[illegible] up for the examination in Engineering and Surveying
(f) Includes 79 studen[illegible] passed in the Examination in Engineering and Surveying
NOTE.—In Madras a[illegible] students have not, in some cases, been distinguished

TABLE VI—*contd.*

Provinces of British India during the official year 1913-14—contd.

PASSED.			RACE OR CREED OF PASSED SCHOLARS.								
Other Institutions	Private Students.	Total	Europeans and Anglo-Indians	Indian Christians	Hindus. Brahmans	Hindus. Non-Brahmans.	Muhammadans.	Buddhists.	Parsis.	Others	NATURE OF EXAMINATIONS
											COLLEGES FOR PROFESSIONAL TRAINING—*contd.*
											Engineering.
..	..	..	..	..	..	..	..	..	..	..	M.C.E.
..	..	20	..	2	10	7	1	..	..	..	B.C.E.
..	..	24	..	1	13	9	..	..	1	..	L.C.E.
..	..	..	..	..	..	..	..	..	..	..	First L.C.E.
..	..	..	..	..	..	..	..	..	..	..	Examination in Art drawing.
..	..	45	..	..	37	..	2	..	6	..	First Examination in Engineering.
											Roorkee College Examinations—
..	..	92	2	2	64	11	2	..	11	..	Civil Engineer.
..	..	..	..	..	..	..	..	..	..	..	Electrical Engineer.
..	..	37	18	..	..	19	..	..	..	..	Upper Subordinate.
..	..	53	..	..	10	42	1	..	..	..	Lower Subordinate.
2	25	(b)528	34	40	187	160	85	2	1	19	*Teaching.*
											Agriculture.
..	[illegible]	27	..	2	16	4	3	..	1	1	L. Ag.
..	[illegible]	17	..	2	14	..	1	..	..	..	Second L. Ag.
..	[illegible]	26	..	..	21	..	1	..	4	..	First L. Ag.
..	..	52	..	..	2	3	37	..	..	10	*Veterinary*
..	..	1	..	..	..	..	..	..	..	1	*Commercial.*
											SCHOOLS FOR GENERAL EDUCATION.
3,695	493	12,680	38	249	4,775	5,208	1,719	222	223	255	Boys } Matriculation Examination
22	20	189	21	70	20	23	..	..	30	16	Girls } Matriculation Examination
805	16	6,652	40	514	3,786	1,903	380	1	15	7	Boys } School Final.
..	[illegible]	[illegible]	..	..	..	..	..	..	..	..	Girls } School Final.
4	[illegible]	131	127	4	..	..	..	..	..	..	Boys } High School Examination for Europeans
1	[illegible]	63	61	1	..	..	..	..	1	..	Girls } High School Examination for Europeans
1	..	299	..	..	156	108	31	2	2	..	Boys } High School Scholarship Examination.
..	..	4	..	4	..	..	..	..	..	..	Girls } High School Scholarship Examination.
..	[illegible]	46	43	1	..	1	[illegible]	..	1	..	Boys } Elementary Certificate Examination
..	[illegible]	51	49	..	..	1	..	..	1	..	Girls } Elementary Certificate Examination
269	389	3,500	[illegible]	30	1,373	1,5[illegible]	[illegible]78	24	4	33	Public Service Certificate Examination.
..	[illegible]	15	[illegible]	13	[illegible]	..	..	..	..	..	Boys Cambridge Preliminary Examination
24	[illegible]	51	42	[illegible]	..	2	..	..	2	4	Boys } Cambridge Senior Examination.
..	..	20	19	[illegible]	..	1	..	..	..	..	Girls } Cambridge Senior Examination.
24	..	101	98	[illegible]	..	..	2	..	1	..	Boys } Cambridge Junior Examination.
..	..	53	46	[illegible]	1	2	1	..	..	1	Girls } Cambridge Junior Examination.
9,934	[illegible]	45,951	523	2,07[illegible]	8,602	19,542	7,601	7,531	124	333	Boys } Middle School Examination.
53	[illegible]	1,472	430	415	50	212	38	249	10	58	Girls } Middle School Examination.
15,654	[illegible]	142,804	473	4,846	24,000	68,276	[illegible]176	20,458	[illegible]	2,281	Boys } Upper Primary Examination.
16	[illegible]	[illegible]7,132	300	995	[illegible]	[illegible]	[illegible]	1,858	[illegible]8	95	Girls } Upper Primary Examination.
15,018	[illegible]	254,706	416	[illegible]	20,041	91,503	38,828	90,509	901	2,478	Boys } Lower Primary Examination
214	[illegible]	25,2[illegible]	716	1,780	2,180	5,056	1,170	12,320	1,038	136	Girls } Lower Primary Examination
											SCHOOLS FOR SPECIAL INSTRUCTION
..	133	1,213	29	52	607	317	[illegible]	45	..	11	Upper } Training School Examination for Masters
11	160	4,525	4	301	2,066	1,305	[illegible]	131	..	79	Lower } Training School Examination for Masters
4	13	396	22	160	[illegible]	91	24	5	3	10	Upper } Training School Examination for Mistresses
10	4	257	[illegible]	[illegible]	[illegible]	41	18	30	1	7	Lower } Training School Examination for Mistresses
..	3	[illegible]	[illegible]	[illegible]	..	2	6	225	[illegible]	[illegible]	Teachers' Examination for students outside Training School.
1,815	340	(d) 11,314	467	728	3,960	4,194	942	[illegible]	[illegible]	85	Schools of Art Examination.
..	[illegible]	69	3	[illegible]	[illegible]	269	[illegible]	[illegible]	[illegible]	[illegible]	Medical Examination
15	[illegible]	(f)571	[illegible]	7	92	312	49	11	..	[illegible]	Examination in Engineering.
231	1	(d)965	[illegible]	212	70	434	203	[illegible]	[illegible]	[illegible]	Examination in Surveying
40	7	186	[illegible]	16	56	81	18	[illegible]	1	[illegible]	[illegible] School Examination
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] School Examination.
209	27	2,075	..	..	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Agricultural School Examination.
7	..	385	..	..	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Sanskrit Title Examination
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Madrassa Central Examination.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Mufassal Maktab Examination
186	184	[illegible]	143	[illegible]	357	1,677	758	[illegible]	101	16	Other Schools Examination.

[illegible] different institutions in [illegible] details of whom are not available.
[illegible] different institutions in Madras, the race and creed of whom is not available.
[illegible] Schools Examinations respectively from the different institutions in Madras, details of whom are not available.
[illegible] Schools Examinations respectively from the different institutions in Madras, details of whom are not available.
[illegible] from the different institutions in Madras, details of whom are not available.
[illegible] from the different institutions in Madras, the race and creed of whom is not available.
[illegible] between Brahmans and non-Brahman [illegible] been shown under Brahmans.

Return showing the distribution of Local Board and Municipal Expenditure

Objects of Expenditure.	Number of Institutions.	EXPENDITURE OF LOCAL IN INSTITUTIONS MANAGED					
		Number of Scholars on the rolls on the 31st of March.	Average number on the rolls monthly during the year.	Average daily attendance.	Provincial Grants.	Local Fund.	Municipal Grants.
					R	R	R
University Education.							
Arts Colleges.							
English	..	..	..	..	..	..	..
Oriental	1	26	26	22	..	6,282	..
College or Departments of Colleges for Professional Training.							
Law	..	..	..	..	..	..	..
Medicine	..	..	..	..	..	..	..
Engineering	..	..	..	..	..	..	..
Teaching	..	..	..	..	..	..	..
Agriculture	..	..	..	..	..	..	..
TOTAL	1	26	26	22	..	6,282	..
School Education, General.							
Secondary Schools.							
For Boys—							
High Schools	21	8,214	8,154	7,400	3,514	10,552	4,295
Middle Schools { English	170	29,034	27,167	23,490	6,065	84,672	18,721
Middle Schools { Vernacular	844	115,782	111,894	90,774	..	7,57,319	31,751
For Girls—							
High Schools	..	..	..	..	..	..	..
Middle Schools { English	..	..	..	..	..	..	..
Middle Schools { Vernacular	4	372	313	244	63	5,710	450
TOTAL	1,048	152,402	147,548	121,914	9,942	8,63,451	55,217
Primary Schools.							
For Boys	30,435	1,762,773	1,683,278	1,423,168	22,47,550	61,04,701	83,095
For Girls	1,813	77,067	72,884	55,444	75,649	4,03,977	14,627
TOTAL	32,248	1,839,840	1,756,162	1,378,612	23,23,199	65,10,678	97,722
School Education, Special.							
Training Schools for Masters	..	..	..	..	..	..	..
Training Schools for Mistresses	240	2,237	2,10[illegible]	[illegible]	7,500	2,09,848	525
Schools of Art	1	6	5	..	..	30	..
Law Schools	..	..	..	..	..	..	..
Medical Schools	..	..	..	..	..	..	..
Engineering and Surveying Schools	..	..	..	..	..	..	..
Technical and Industrial Schools	..	..	..	..	..	..	..
Commercial Schools	31	1,412	1,322	1,02[illegible]	1,504	23,000	1,373
Agricultural Schools	..	..	..	..	..	..	..
Other Schools	..	..	..	..	..	..	..
	2	194	164	140	527	251	..
TOTAL	283	3,849	3,688	3,290	10,531	2,73,165	1,898
Buildings	..	..	..	..	[illegible]	[illegible]	[illegible]
Furniture and apparatus	..	..	..	..	[illegible]	[illegible]	[illegible]
TOTAL	..	..	..	..	96,109	29,09,161	[illegible]
University	..	..	..	..	..	..	..
Inspection	..	..	..	..	..	..	..
Scholarships held in: Arts Colleges	..	..	..	..	..	..	..
Scholarships held in: Medical Colleges	..	..	..	..	..	..	..
Scholarships held in: Other Professional Colleges	..	..	..	..	..	..	..
Scholarships held in: Secondary Schools	..	..	..	..	..	..	..
Scholarships held in: Primary Schools	..	..	..	..	..	..	..
Scholarships held in: Medical Schools	..	..	..	..	..	..	..
Scholarships held in: Technical and Industrial Schools	..	..	..	..	..	..	..
Scholarships held in: Other Special Schools	..	..	..	..	..	..	..
Miscellaneous	..	..	..	..	..	..	..
TOTAL	..	..	..	..	..	..	..
GRAND TOTAL	33,580	1,096,117	1,907,421	1,503,838	23,[illegible]81	1,05,67,170	[illegible]

TABLE VII.

on Public Instruction in British India for the official year 1913-14.

BOARDS ON PUBLIC INSTRUCTION.								
BY LOCAL BOARDS.				IN INSTITUTIONS MANAGED BY				
Fees	Subscriptions.	Endowments and other sources.	Total.	Government.	Municipal Boards.	Private persons or Associations.	Total Local Boards' expenditure on Public Instruction.	OBJECTS OF EXPENDITURE.
R	R	R	R	R	R	R	R	UNIVERSITY EDUCATION.
								Arts Colleges.
..	..	..	..	..	..	18,050	18,050	English.
..	..	..	6,282	..	..	96	6,378	Oriental.
								Colleges or Departments of Colleges for Professional Training.
..	..	..	..	4,276	..	..	4,276	Law.
..	..	..	..	..	..	..	..	Medicines.
..	..	..	..	1,691	..	..	1,691	Engineering.
..	..	..	..	..	..	..	..	Teaching.
..	..	..	..	..	..	..	..	Agriculture.
..	..	..	6,282	5,967	..	18,146	30,395	TOTAL.
								SCHOOL EDUCATION, GENERAL.
								Secondary Schools.
1,64,354	..	762	1,83,808	2,957	1,054	15,250	30,753	For Boys—
2,85,473	8,001	2,067	4,06,099	13	12,572	1,06,763	2,04,220	High Schools.
2,03,088	6,021	1,415	10,09,024	600	5,767	2,02,102	0,75,797	English } Middle Schools.
								Vernacular }
..	..	..	..	..	..	..	..	For Girls—
..	..	..	..	..	..	783	783	High Schools.
..	..	7	6,230	..	..	20,712	26,422	English } Middle Schools.
								Vernacular }
6,53,915	14,022	4,251	16,05,761	3,570	20,293	4,35,619	13,27,975	TOTAL.
								Primary Schools.
7,37,103	32,751	23,886	92,31,170	430	59,569	20,80,043	82,46,743	For Boys.
242	2,048	291	4,06,234	657	11,018	3,36,342	7,51,304	For Girls.
7,37,435	34,799	24,177	97,37,410	1,087	70,587	24,16,385	89,98,137	TOTAL.
								SCHOOL EDUCATION, SPECIAL.
26	..	8	2,17,901	60,652	..	594	2,67,094	Training Schools for Masters.
..	..	..	6,378	..	..	72	8,486	Training Schools for Mistresses.
..	..	..	..	..	..	..	..	Schools of Art.
..	..	..	..	..	..	..	..	Law Schools.
..	..	..	..	3,504	..	400	3,964	Medical Schools.
..	..	..	..	..	..	950	950	Engineering and Surveying Schools.
4,905	2,253	13,002	95,127	1,493	1,800	10,914	86,207	Technical and Industrial Schools.
..	..	..	..	702	..	..	702	Commercial Schools.
215	5	..	1,048	90	16	1,48,318	1,48,075	Agricultural Schools.
								Other Schools.
5,230	288	13,994	3,14,112	78,930	1,816	1,67,248	5,16,168	TOTAL.
127	35,731	6,050	28,31,810	65	..	1,98,210	28,43,704	Buildings.
1,186	6,490	650	3,13,225	370	..	47,750	3,00,868	Furniture and apparatus.
1,313	42,227	7,588	31,45,135	435	..	2,45,975	31,55,572	TOTAL.
..	..	..	..	..	..	..	1,84,624	Scholarships held in Universities and Colleges for Instruction.
..	..	..	..	..	..	..	7,077	Arts Colleges.
..	..	..	..	..	..	..	1,980	Medical Colleges.
..	..	..	..	..	..	..	6,097	Other Professional Colleges.
..	..	..	..	..	..	..	71,70,524	Secondary Schools.
..	..	..	..	..	..	..	69,424	Primary Schools.
..	..	..	..	..	..	..	7,202	Medical Schools.
..	..	..	..	..	..	..	20,082	Technical and Industrial Schools.
..	..	..	..	..	..	..	6,935	Other Special Schools.
..	..	..	..	..	..	..	2,68,430	Miscellaneous.
..	..	..	..	..	..	..	7,62,289	TOTAL.
13,98,899	92,250	50,008	1,47,08,700	85,008	92,003	32,83,373	147,00,536	GRAND TOTAL.

Return showing the distribution of Local Board and Municipal Expenditure on

Objects of Expenditure	Expenditure of Municipal							
	In Institutions managed							
	Number of Institutions	Number of Scholars on the rolls on the 31st of March.	Average number on the rolls monthly during the year.	Average daily attendance.	Provincial Grants.	Municipal rates.	Local Boards' Grants	Fees.
University Education					R	R	R	R
Arts Colleges.								
English	4	485	506	456	2,657	4	..	42,283
Oriental	..	..	..	..	..	..	..	..
Colleges or Departments of Colleges for Professional Training								
Law	1	8	9	6	..	..	..	706
Medicine	..	..	..	..	..	..	..	..
Engineering	..	..	..	..	..	..	..	..
Teaching	..	..	..	..	..	..	..	..
Agriculture	..	..	..	..	..	..	..	..
Total	5	493	515	462	2,657	4	..	42,989
School Education, General								
Secondary Schools								
For Boys—								
High Schools	35	12,690	12,534	11,253	59,715	41,657	1,054	2,56,461
Middle Schools { English	134	10,630	18,238	16,687	34,330	1,57,062	12,572	1,88,717
Middle Schools { Vernacular	35	6,508	6,238	5,331	..	41,463	6,767	7,273
For Girls—								
High Schools	..	..	..	..	..	..	..	..
Middle Schools { English	2	132	123	80	1,037	4,541	..	88
Middle Schools { Vernacular	10	1,545	1,492	1,175	230	20,356	..	244
Total	216	40,514	38,625	34,526	95,308	2,64,979	20,293	4,52,783
Primary Schools								
For Boys	1,778	203,970	194,611	154,353	3,83,102	11,67,994	59,560	1,51,055
For Girls	547	44,526	41,846	28,785	95,930	3,16,370	11,018	5,091
Total	2,325	248,496	236,457	183,138	4,78,032	14,83,364	70,587	1,56,146
School Education, Special								
Schools for Special Instruction								
Training Schools for Masters	2	12	11	10	..	1,600	..	..
Training Schools for Mistresses	2	25	28	24	1,541	1,283	..	..
Schools of Art	..	..	..	..	..	..	..	..
Law Schools	..	..	..	..	..	..	..	..
Medical Schools	..	..	..	..	..	..	..	..
Engineering and Surveying Schools	..	..	..	..	..	..	..	..
Technical and Industrial Schools	9	942	851	720	5,798	23,531	1,800	659
Commercial Schools	1	101	103	85	849	840	..	979
Agricultural Schools	..	..	..	..	..	..	..	..
Reformatory Schools	..	..	..	..	..	..	..	..
Other Schools	6	170	166	113	1,314	2,692	16	..
Total	20	1,250	1,160	952	11,502	29,955	1,816	1,638
Buildings	..	..	..	..	61,591	4,50,226	..	80
Furniture and apparatus	..	..	..	..	28,928	32,511	..	80
Total	..	..	..	..	90,519	4,83,737	..	160
University	..	..	..	..	..	..	..	..
Inspection	..	..	..	..	..	..	..	..
Scholarships held in: Arts Colleges	..	..	..	..	..	..	..	..
Scholarships held in: Medical Colleges	..	..	..	..	..	..	..	..
Scholarships held in: Other Professional Colleges	..	..	..	..	..	..	..	..
Scholarships held in: Secondary Schools	..	..	..	..	..	..	..	..
Scholarships held in: Primary Schools	..	..	..	..	..	..	..	..
Scholarships held in: Medical Schools	..	..	..	..	..	..	..	..
Scholarships held in: Technical and Industrial Schools	..	..	..	..	..	..	..	..
Scholarships held in: Other Special Schools	..	..	..	..	..	..	..	..
Miscellaneous	..	..	..	..	..	..	..	..
Total	..	..	..	..	..	..	..	..
GRAND TOTAL	12,568	290,753	276,756	219,078	6,78,618	22,67,039	92,696	6,53,716

TABLE VII—*contd.*

Public Instruction in British India for the official year 1913-14—contd.

BOARDS ON PUBLIC INSTRUCTION.								
BY MUNICIPAL BOARDS.			IN INSTITUTIONS MANAGED BY			Total Municipal Expenditure on Public Instruction.	Total Expenditure of Local and Municipal Boards on Public Instruction.	OBJECTS OF EXPENDITURE.
Subscriptions.	Endowments and all other sources.	Total.	Government.	Local Boards.	Private persons or Associations.			
R	R	R	R	R	R	R	R	UNIVERSITY EDUCATION.
								Arts Colleges.
..	2,011	46,055	6,000	..	25,223	31,227	49,277	English.
..	..	..	..	..	410	410	6,788	Oriental.
								Colleges or Departments of Colleges for Professional Training.
..	..	706	..	..	..	..	..	Law.
..	..	..	2,507	..	..	2,507	6,783	Medicine.
..	..	..	..	..	..	..	..	Engineering.
..	..	..	138	..	..	138	1,829	Teaching.
..	..	..	..	..	..	..	..	Agriculture
..	2,011	47,661	8,645	..	25,633	34,282	64,677	TOTAL.
								SCHOOL EDUCATION, GENERAL.
								Secondary Schools.
..	2,297	3,01,984	32,951	4,205	1,63,553	2,42,356	2,73,100	For Boys— High Schools.
1,441	3,020	3,07,142	3,381	18,721	1,42,177	3,21,341	6,15,561	English } Middle Schools.
..	26	54,620	..	31,781	77,395	1,50,630	11,26,436	Vernacular }
..	..	..	..	..	10,853	10,853	19,853	For Girls— High Schools.
..	..	5,662	..	..	25,302	20,843	30,626	English } Middle Schools.
..	54	20,884	72	450	34,283	55,161	81,583	Vernacular }
1,441	5,397	8,40,201	36,404	55,247	4,02,563	8,10,103	21,47,168	TOTAL.
								Primary Schools.
794	5,093	17,07,607	96	83,095	3,28,809	15,79,958	98,26,701	For Boys.
220	1,894	4,29,123	518	14,627	1,25,736	4,50,251	12,07,645	For Girls.
1,014	6,987	21,96,730	614	97,722	4,54,545	20,30,209	1,10,34,346	TOTAL.
								SCHOOL EDUCATION, SPECIAL.
								Schools for Special Instruction.
..	..	1,609	5,824	525	34	7,992	2,75,086	Training Schools for Masters.
..	..	2,824	3,949	..	348	5,480	13,966	Training Schools for Mistresses.
..	..	..	..	..	350	350	350	Schools of Art.
..	..	..	..	..	..	..	..	Law Schools.
..	..	..	..	..	2,700	2,700	6,664	Medical Schools.
..	..	..	..	..	150	150	1,100	Engineering and Surveying Schools.
55	5,984	37,827	..	1,373	33,158	58,002	1,44,269	Technical and Industrial Schools.
..	..	2,668	..	..	..	840	840	Commercial Schools.
..	..	..	..	..	..	..	792	Agricultural Schools.
..	..	..	1,348	..	..	1,348	1,348	Reformatory Schools
..	..	6,022	2,800	..	35,329	40,821	1,89,496	Other Schools.
55	5,984	50,950	13,821	1,898	72,069	1,17,743	6,33,011	TOTAL.
12,563	3,133	5,33,503	..	86,187	35,064	5,77,477	31,26,181	Buildings.
..	888	62,407	..	2,452	9,343	44,306	3,51,174	Furniture and apparatus.
12,563	4,021	5,96,000	..	88,639	44,407	6,21,783	37,77,355	TOTAL.
..	..	..	..	..	..	..	..	University.
..	..	..	..	..	..	13,027	1,97,051	Inspections.
..	..	..	..	..	..	4,347	12,326	Scholarships held in: Arts Colleges.
..	..	..	..	..	..	332	2,318	Medical Colleges.
..	..	..	..	..	..	452	6,549	Other Professional Colleges.
..	..	..	..	..	..	19,157	1,89,981	Secondary Schools.
..	..	..	..	..	..	7,675	66,009	Primary Schools.
..	..	..	..	..	..	503	7,765	Medical Schools.
..	..	..	..	..	..	4,352	24,434	Technical and Industrial Schools.
..	..	..	..	..	..	1,554	8,489	Other Special Schools.
..	..	..	..	..	..	85,507	3,81,003	Miscellaneous.
..	..	..	..	..	..	1,37,326	8,99,615	TOTAL.
15,073	24,400	32,31,542	59,484	2,43,506	30,59,217	37,00,536	1,85,57,072	GRAND TOTAL.

Attendance and expenditure in hostels

	Number of		Number of boarders who are students			
	Hostels or Boarding Houses.	Boarders.	Arts Colleges.	Colleges for Professional Training.	Secondary Schools.	Primary Schools.
MANAGED BY GOVERNMENT—						
Boys	589	21,690	2,742	1,535	8,938	660
Girls	40	1,532	31	103	885	134
MANAGED BY LOCAL OR MUNICIPAL BOARDS—						
Boys	727	15,077	99	17	13,797	1,171
Girls	..	..	..	..	..	..
AIDED BY GOVERNMENT OR BY LOCAL OR MUNICIPAL BOARDS—						
Boys	432	22,533	1,125	95	14,293	5,750
Girls	228	13,034	36	74	8,384	4,031
MAINTAINED BY NATIVE STATES—						
Boys	67	1,103	144		553	214
Girls	1	38				3
UNAIDED—						
Boys	1,009	40,824	6,114	291	23,707	7,494
Girls	226	12,876	90	10	4,883	6,892
TOTAL—						
Boys	2,824	102,127	10,214	1,938	61,368	15,319
Girls	495	27,480	157	187	14,152	11,060
GRAND TOTAL	3,319	129,607	10,371	2,125	75,520	26,379

TABLE VIII.

or boarding houses for the official year 1913-14.

OF	EXPENDITURE FROM						
Special Schools.	Provincial Revenues.	Local or Municipal Funds.	Subscriptions and Endowments.	Fees.	Native States Revenues.	Total expenditure.	
	R	R	R	R	R	R	MANAGED BY GOVERNMENT—
7,815	3,23,148	1,222	1,19,763	7,14,306	131	11,58,570	Boys.
379	98,372	..	53,260	40,019	100	1,92,651	Girls.
							MANAGED BY LOCAL OR MUNICIPAL BOARDS—
893	1,054	94,632	3,784	62,807	..	1,62,177	Boys.
..	..	..	..	..	..	..	Girls.
							AIDED BY GOVERNMENT OR BY LOCAL OR MUNICIPAL BOARDS—
1,270	2,70,383	31,551	4,00,059	7,71,474	2,734	15,07,101	Boys.
509	2,66,843	10,065	4,10,381	6,76,747	..	13,64,036	Girls.
							MAINTAINED BY NATIVE STATES—
[illegible]	[illegible]	[illegible]	[illegible]	25,038	18,459	44,1[illegible]	Boys.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]41	Girls.
							U
3,218	1,025	224	[illegible]	[illegible]	..	18,43,371	
1,001	..	..	4,03,901	[illegible]	..	6,09,098	
13,[illegible]	[illegible]	1,27,599	[illegible]	[illegible]	21,32[illegible]	[illegible]	
1,024	[illegible]	[illegible]	[illegible]	[illegible]	214	22,25,929	
15,102	[illegible]	1,57,594	22,97,938	35,84,225	21,568	70,01,250	GRAND TOTAL.

Number and qualification of teachers in the several

			(a) In Primary Schools.						(b) In Middle Schools.					
			Government.	Board.	Municipal.	Native States.	Aided.	Unaided.	Government.	Board.	Municipal.	Native States.	Aided.	Unaided.
In Schools for Indians.	Teachers of vernacular.	Trained	684	13,540	746	42	8,446	547	416	2,745	312	8	3,029	903
		Untrained	978	19,833	1,647	495	59,990	11,511	170	1,384	254	20	5,725	1,508
		TOTAL	1,662	33,382	2,393	537	68,436	12,058	586	5,129	566	28	8,754	2,411
	Anglo-Vernacular Teachers and Teachers of classical languages.	Trained	1,106	11,925	3,012	6	18,540	572	284	335	189	..	1,303	78
		Untrained	375	14,596	3,228	6	23,762	4,763	343	520	492	44	4,170	1,797
		TOTAL	1,481	26,521	6,240	12	32,311	5,335	627	855	681	44	5,473	1,875
		Possessing a degree	12	..	..	..	17	..	50	41	55	..	233	73
		Possessing no degree	1,469	26,521	6,240	12	32,294	5,335	577	814	626	44	5,240	1,802
		TOTAL	1,481	26,521	6,240	12	32,311	5,335	627	855	681	44	5,473	1,875
In Schools for Europeans		Trained	4	..	..	..	164	1	6	..	..	..	401	8
		Untrained	..	..	..	..	225	6	3	..	..	..	351	5
		TOTAL	4	..	..	..	389	7	9	..	..	..	752	13
		Possessing a degree	..	..	..	..	2	..	1	..	..	..	40	..
		Possessing no degree	4	..	..	..	386	7	8	..	..	..	712	13
		TOTAL	4	..	..	..	389	7	9	..	..	..	752	13
GRAND TOTAL OF ALL TEACHERS			3,147	59,903	8,433	549	101,136	17,400	1,223	5,984	1247	72	13,979	4,299

TABLE IX.

provinces of British India for 1913-14.

(c) In High Schools.						(d) In Colleges.								
Government.	Board.	Municipal.	Native States.	Aided.	Unaided.	Government.	Board.	Municipal.	Native States.	Aided.	Unaided.	Total.		
372	24	31	..	802	351	..	..	..	..	1	..	34,008	Trained.	Teachers of vernacular. — In Schools for Indians.
211	19	25	..	847	820	1	..	..	..	..	..	105,438	Untrained.	
583	43	56	..	1,649	1,171	1	..	..	..	1	..	139,446	TOTAL.	
1,177	181	210	..	2,820	178	110	2	16	..	241	16	32,328	Trained.	Anglo-Vernacular Teachers and Teachers of classical languages. — In Schools for Indians.
1,950	113	289	12	6,427	4,369	338	1	12	..	666	286	68,559	Untrained	
3,127	294	509	12	9,256	4,547	448	3	28	..	907	302	100,887	TOTAL.	
1,052	61	141	6	3,470	1,116	409	2	21	..	730	274	6,762	Possessing a degree.	
2,075	233	367	6	5,786	3,432	39	1	7	..	177	28	91,125	Possessing no degree.	
3,127	294	508	12	9,256	4,547	41	3	28	..	907	302	100,897	TOTAL.	
50				483	33				..	3	5	1,159	Trained.	In Schools for Europeans.
32				306	30				..	2	3	1,053	Untrained.	
82				879	63				..	5	8	2,211	TOTAL.	
9				189	2				..	4	4	208	Possessing a degree.	
73				740	55				..	1	4	2,003	Possessing no degree.	
82				879	63				..	5	8	2,211	TOTAL.	
3,702	337	561	12	11781	5,781	449	3	28	..	912	310	242,544	GRAND TOTAL OF ALL TEACHERS.	

LIST OF ILLUSTRATIONS.

COLLEGES.

SECONDARY SCHOOLS.

PRIMARY SCHOOLS.

TRAINING INSTITUTIONS.

S. P. G. Training School, Nandyal, Madras Presidency.
Class Rooms, Training College for Men, Dharwar, Bombay Presidency.
Normal School, Lyallpur, Punjab.
Normal School for Men, Nagpur, Central Provinces.
Patna *Mianji*-training School, Bihar and Orissa.
Hostel attached to the Patna-*Mianji*-training School, Bihar and Orissa.
Jagatsinghpur *Guru*-training School, Cuttack, Bihar and Orissa.

SPECIAL AND TECHNICAL SCHOOLS.

Government School of Commerce, Calicut, Madras Presidency.
Dacca School of Engineering Hostel, Bengal.
New Workshops, Mayo School of Art, Lahore.
New Workshop, Ranchi Industrial School, Bihar and Orissa

EUROPEAN SCHOOLS.

Boys' Orphanage, Lahore.
A. B. M. European School, Rangoon.
St. John's Church of England School, Toungoo, Burma.
St. Teresa's, Kidderpore, Bengal.

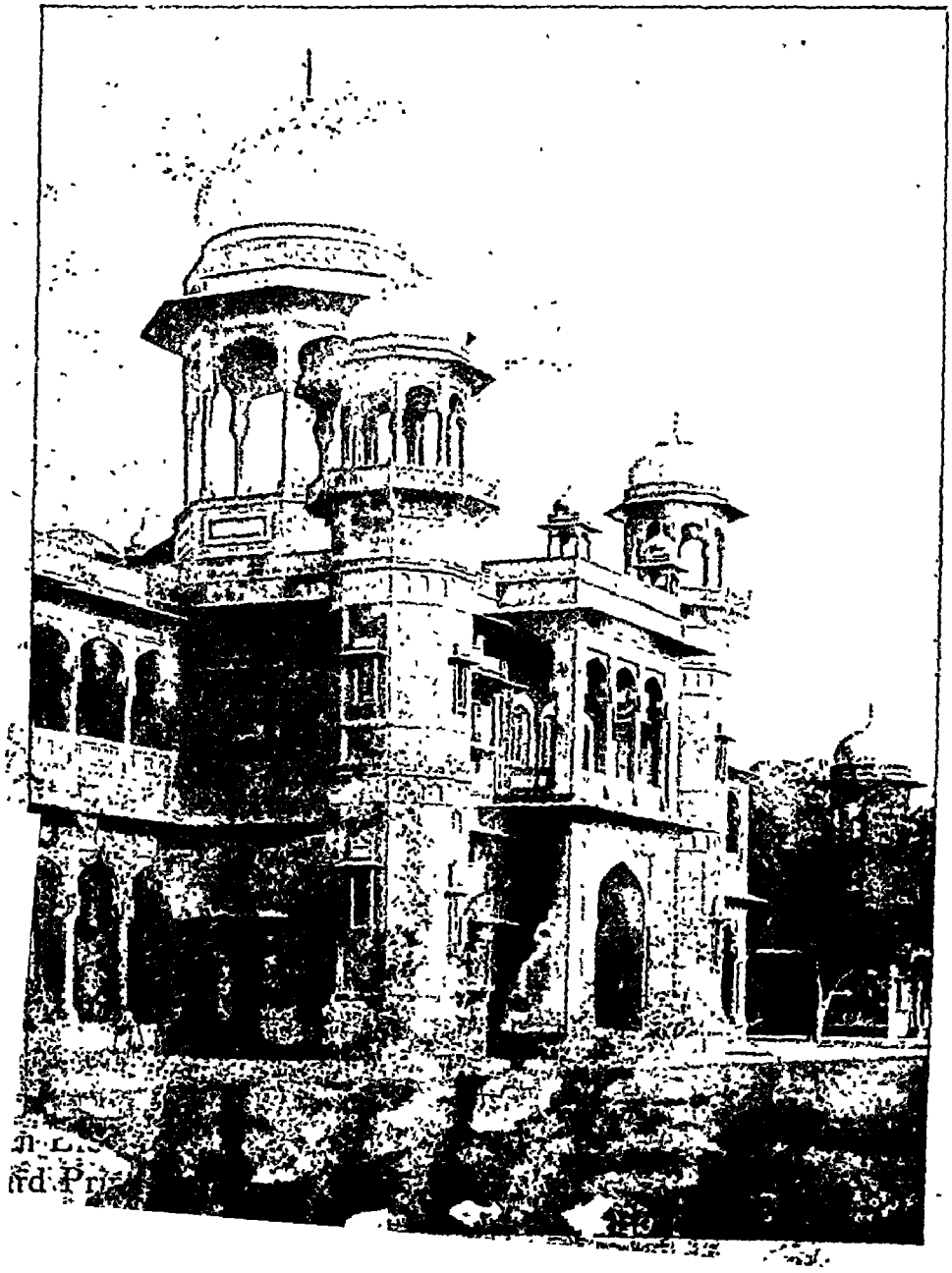


Photo -Mechl. Dept., Thomason College, Roorkee.

ISLAMIA COLLEGE, PESHAWAR.

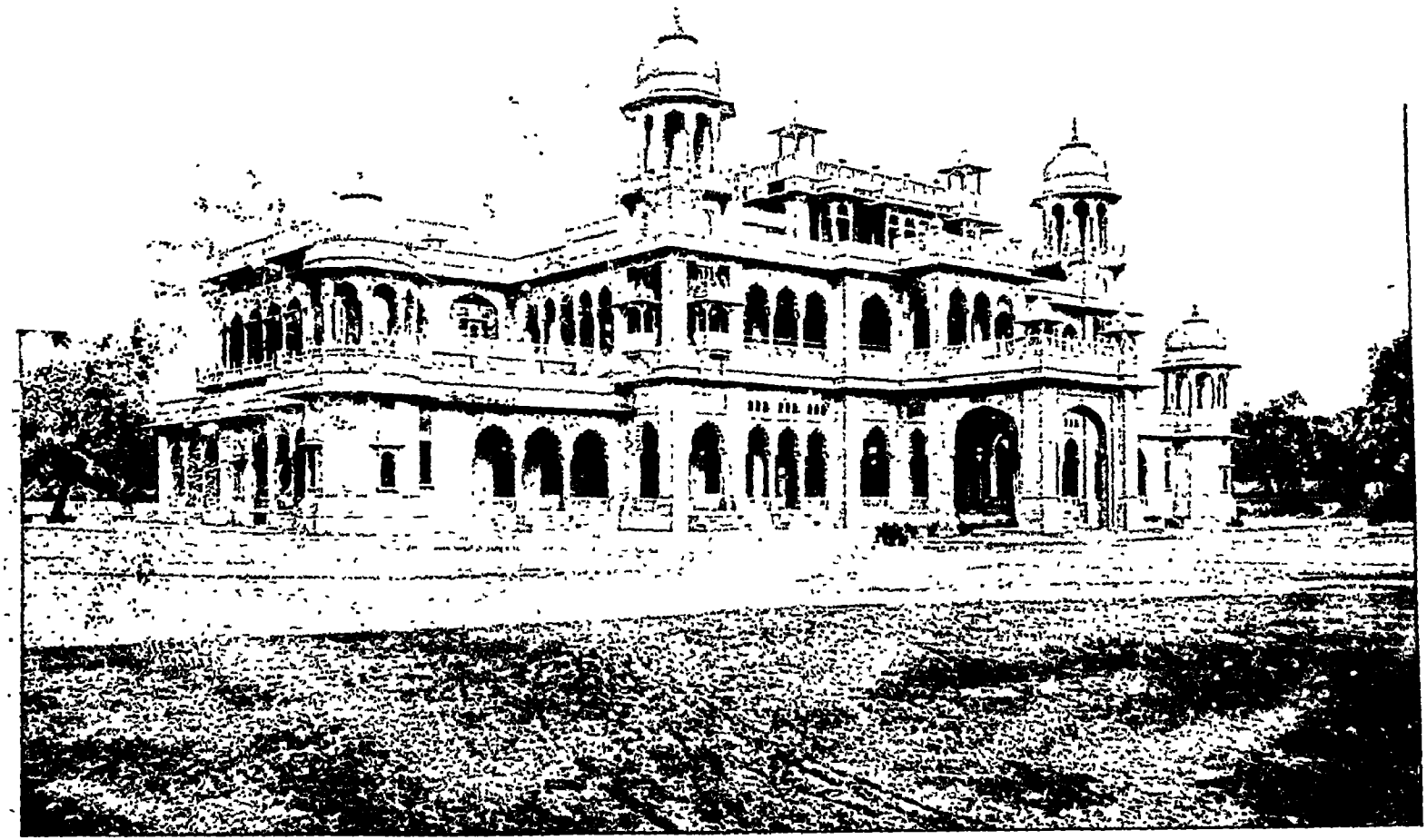


Photo.-Mechl. Dept., Thomason College, Roorkee.

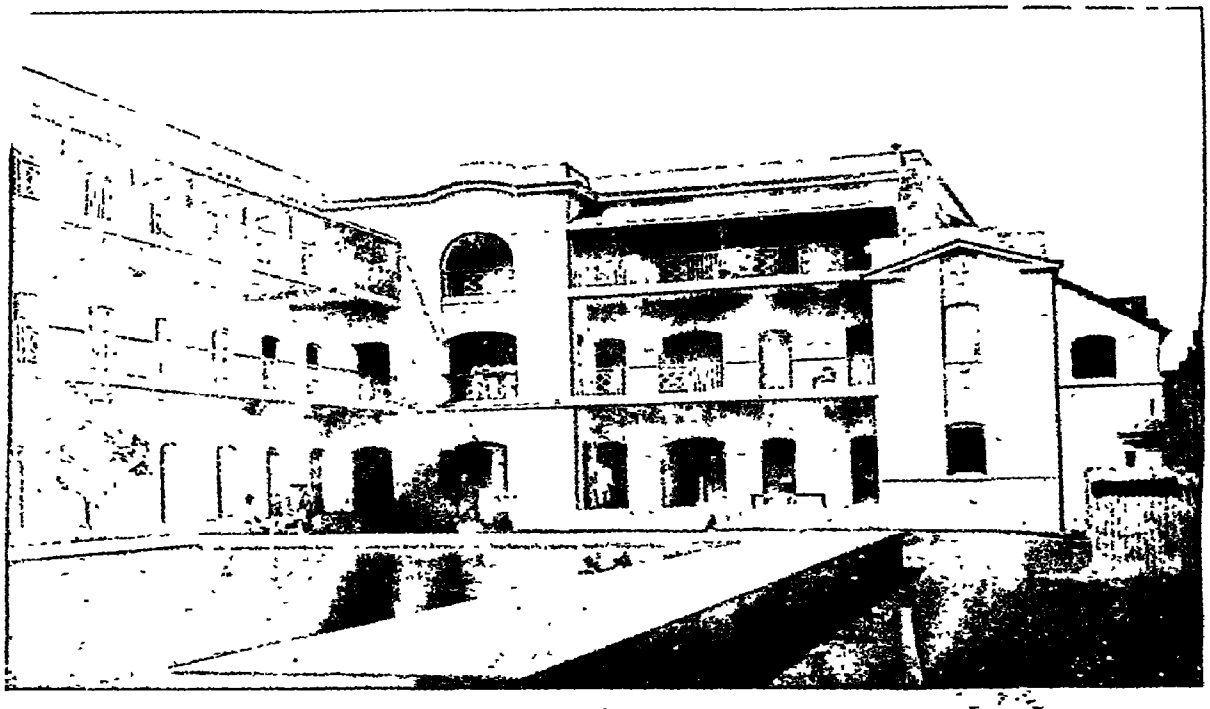
LAW COLLEGE, ALLAHABAD.

Photo-Mechl. Dept., Thomason College, Roorkee

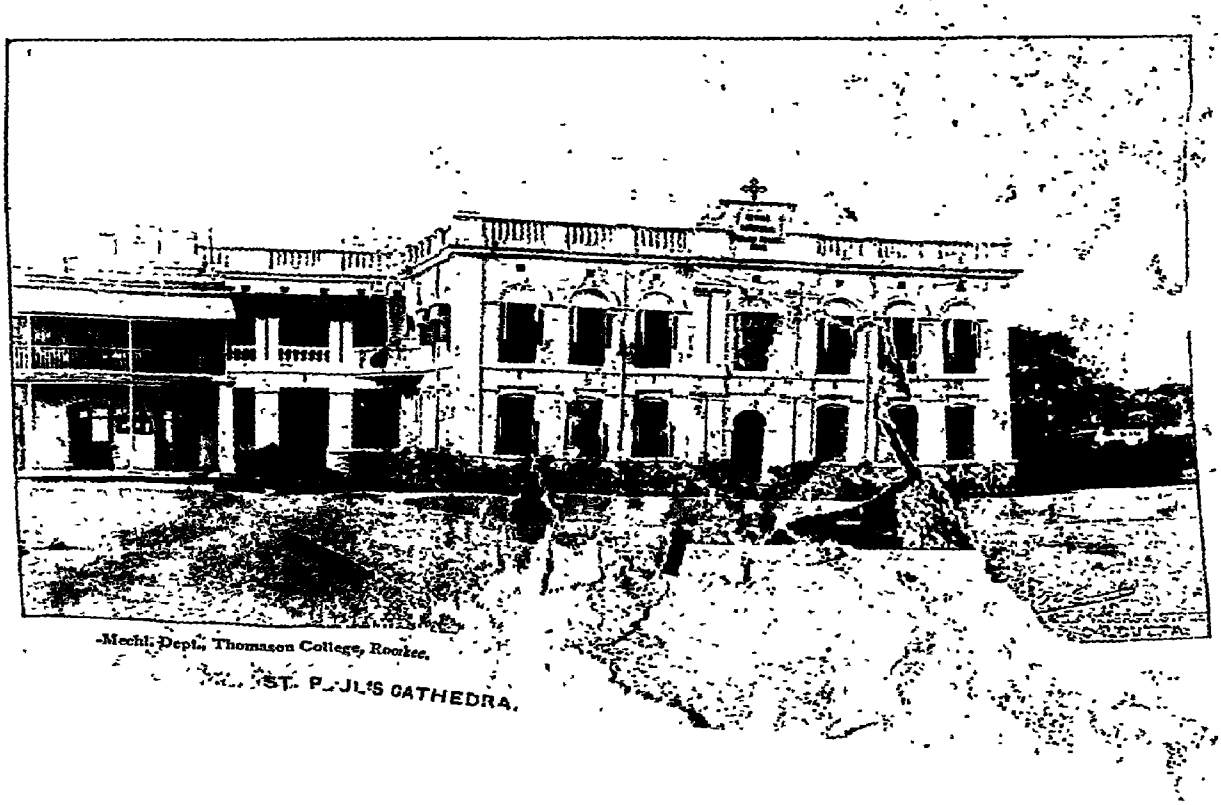
VISTA OF COTTON COLLEGE HINDU HOSTELS, GAUHATI.

Photo.-Mechl. Dept., Thomason College, Roorkee.

NEW MOSLEM HOSTEL, COTTON COLLEGE, GAUHATI.



ST. PAUL'S CATHEDRAL MISSION COLLEGE, HOSTEL.



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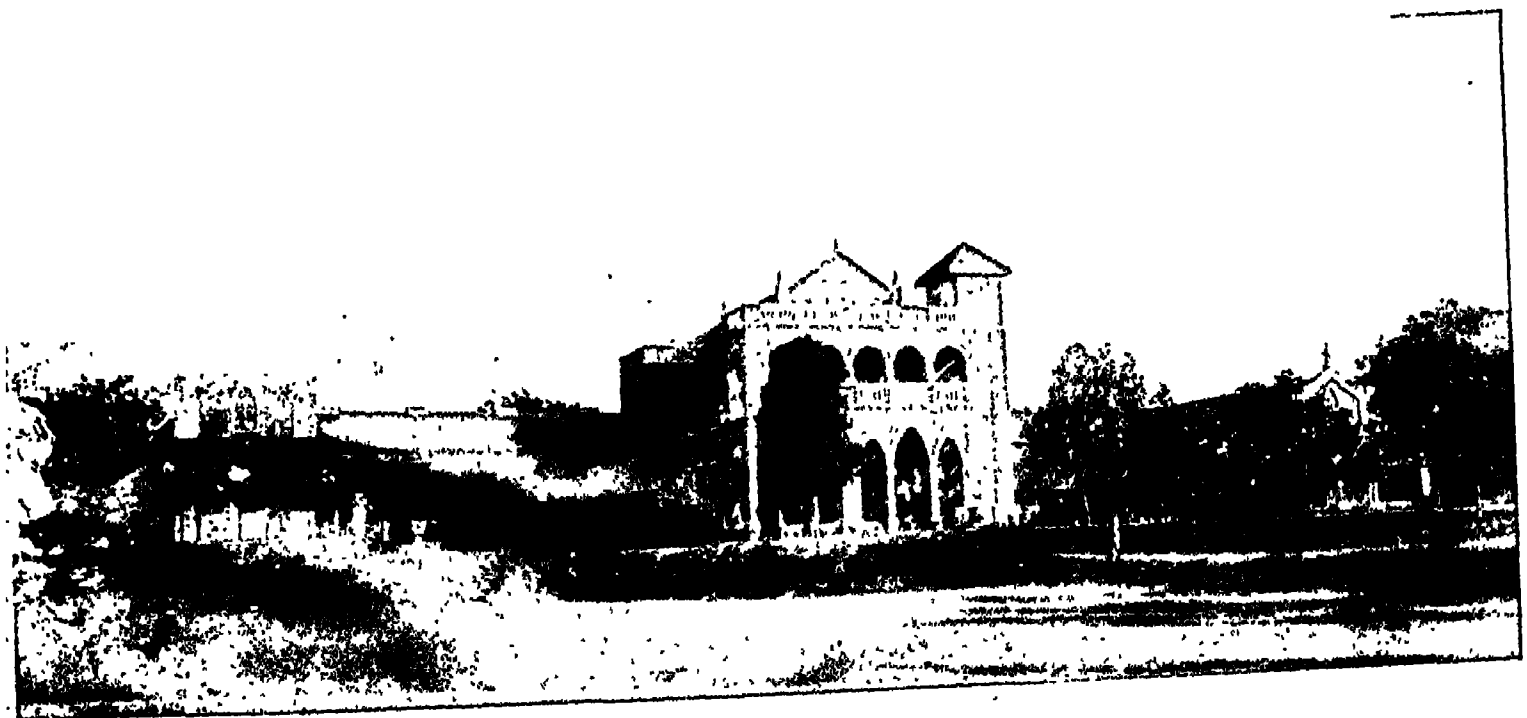
ST. PAUL'S CATHEDRAL



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NORTHCOTE HIGH SCHOOL, SHOLAPUR..

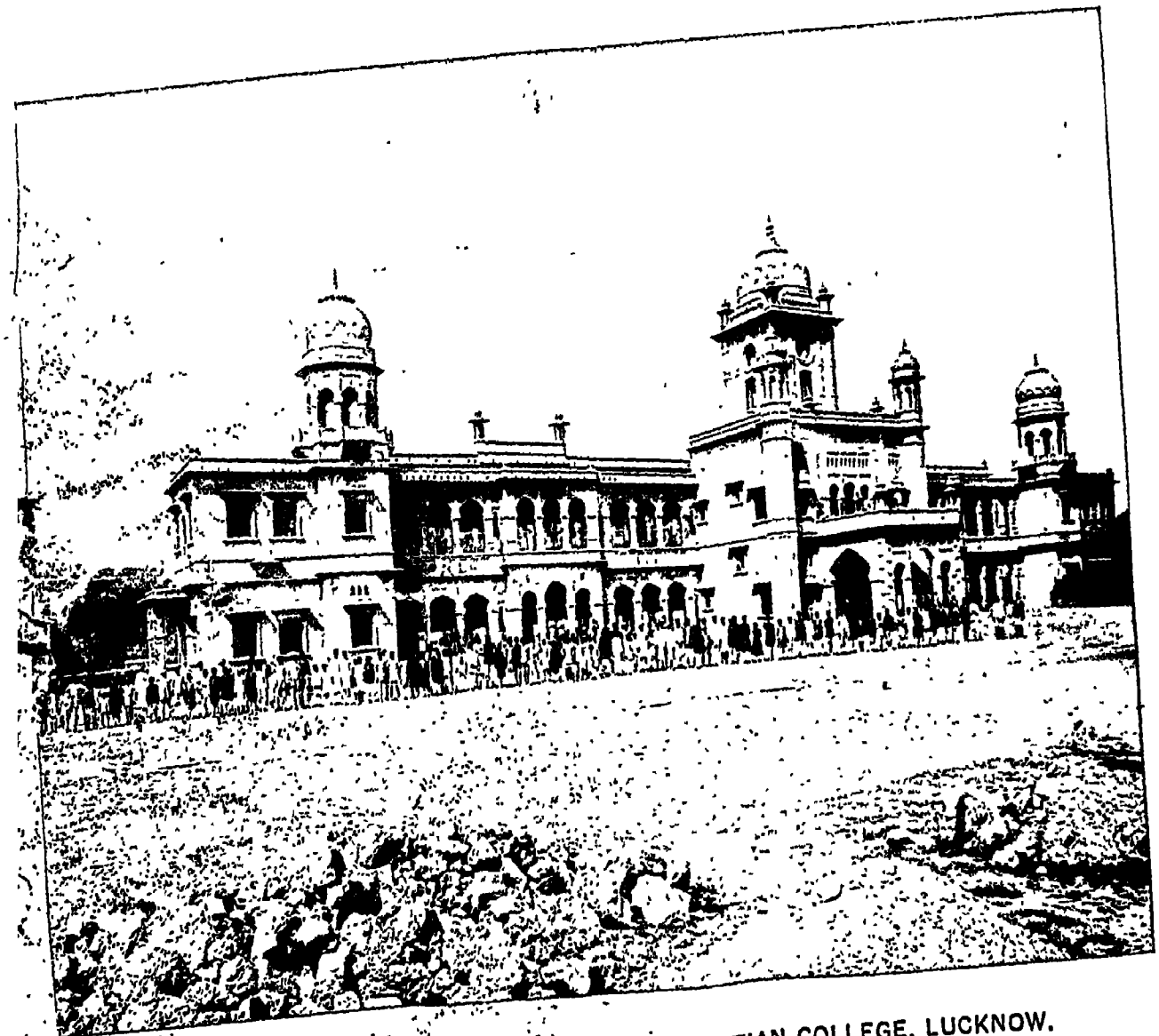

Photo-Mechl. Dept., Thomason College, Roorkee.

NEW COLLEGIATE (HIGH) SCHOOL, REID CHRISTIAN COLLEGE, LUCKNOW.

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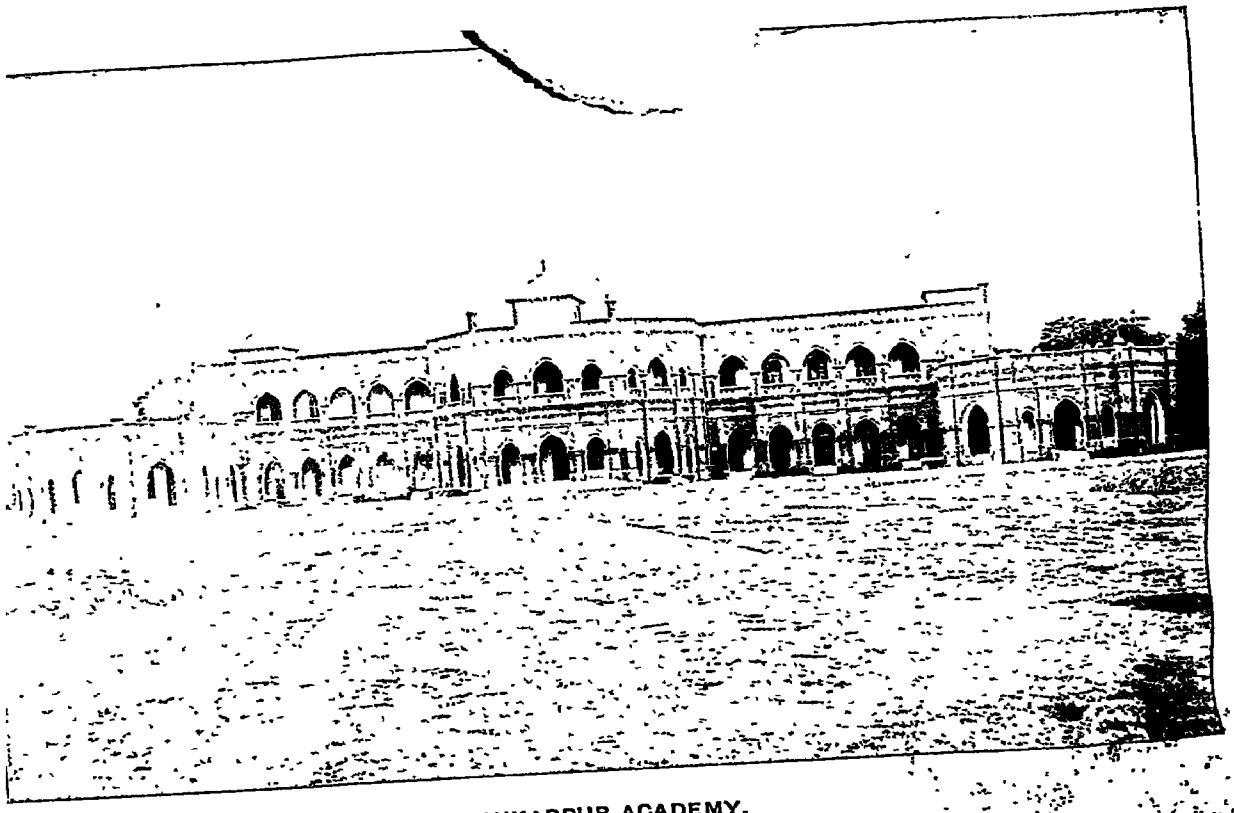
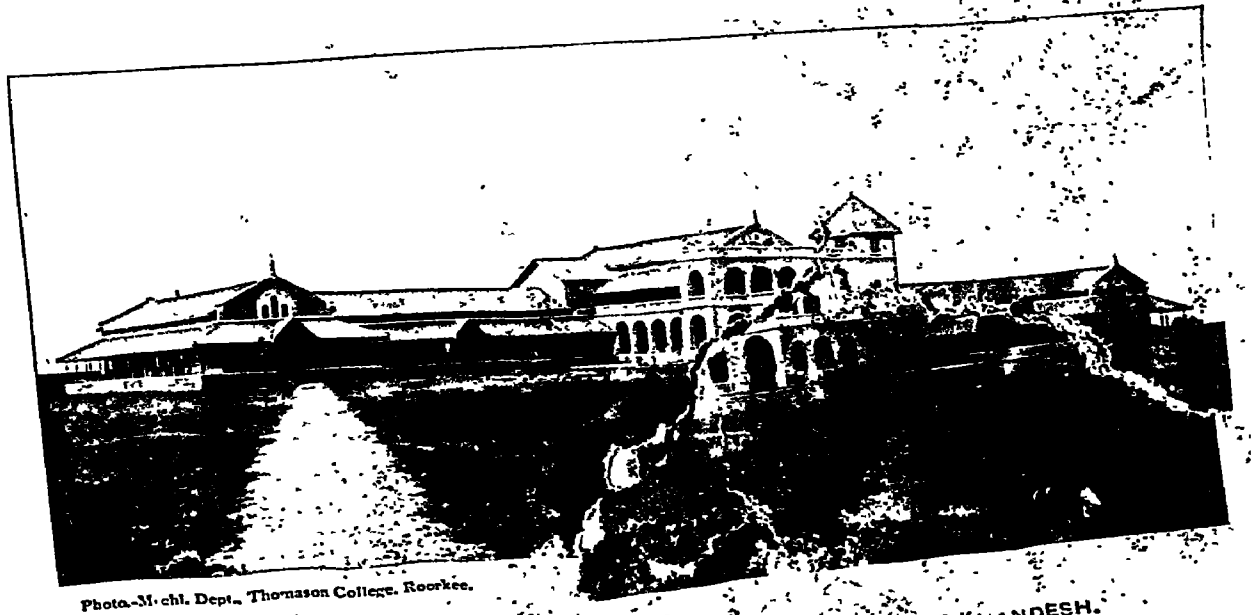
GOVERNMENT ANGLO-VERNACULAR SCHOOL, KYAIKLAT.



SHIKARPUR ACADEMY.



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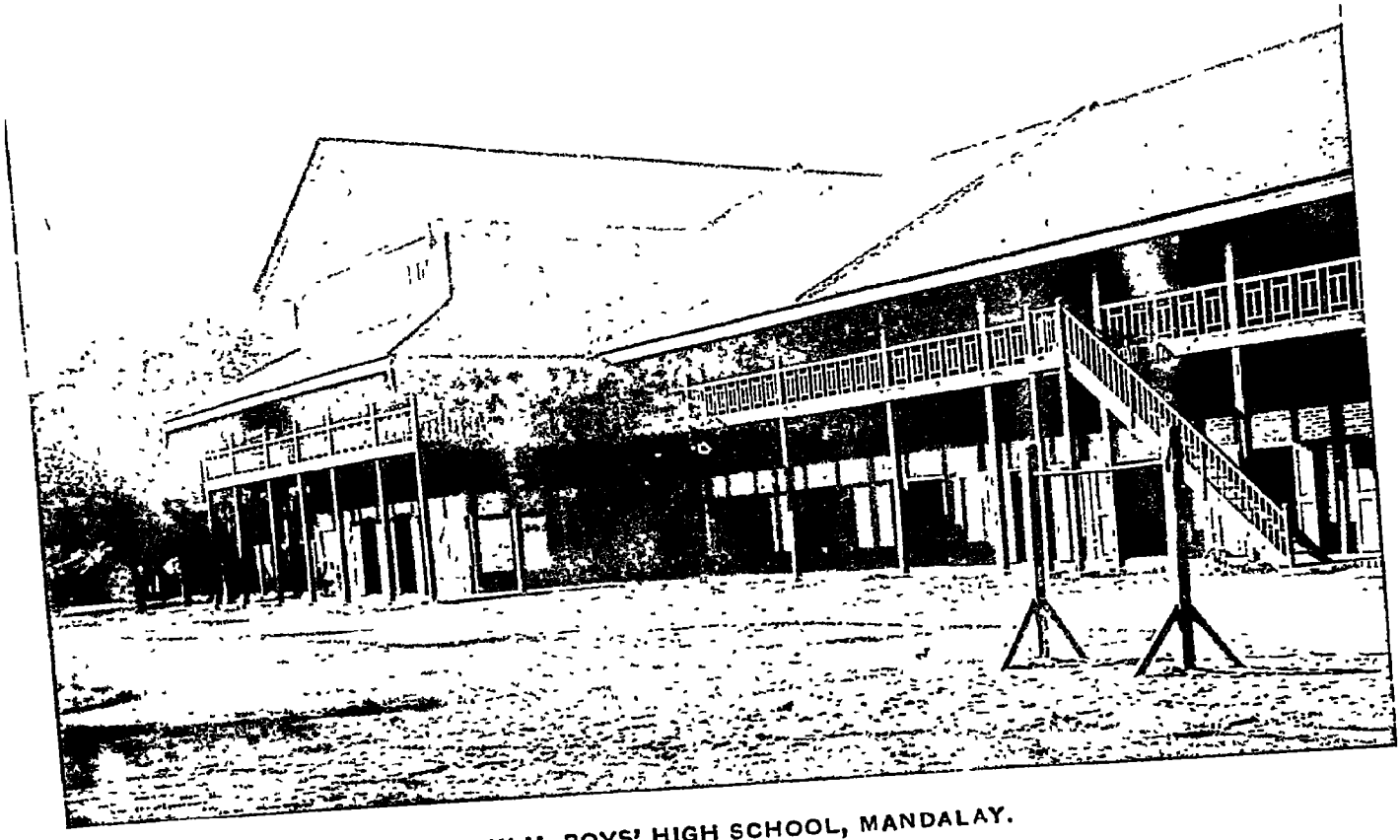
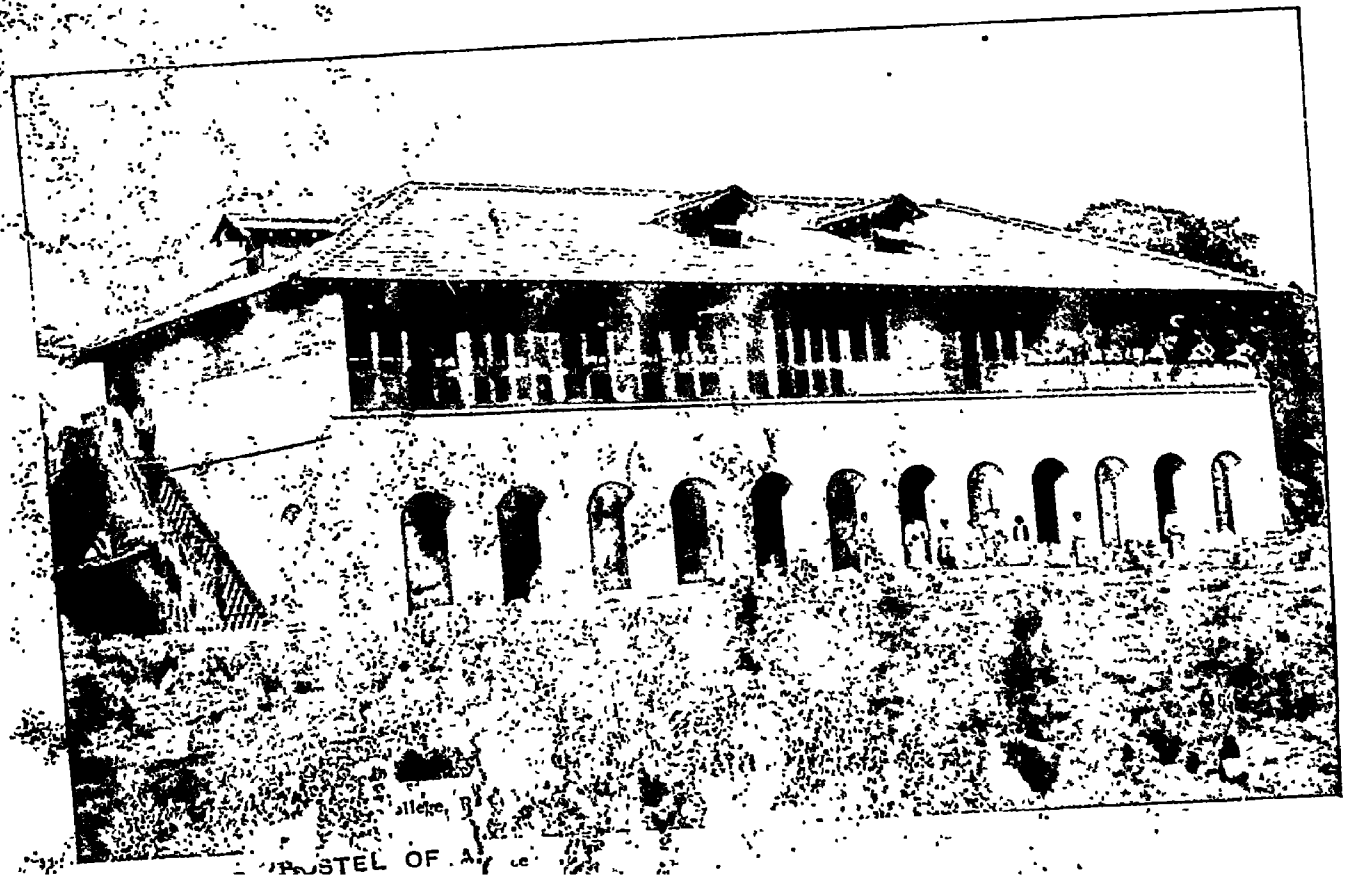
GOVARDHAN DAS SUNDA[illegible] HIGH SCHOOL, AHMEDNAGAR KHANDESH.



E.W.M. BOYS' HIGH SCHOOL, MANDALAY.



HOSTEL OF THE SARDARS' HIGH SCHOOL, BELGAUM.

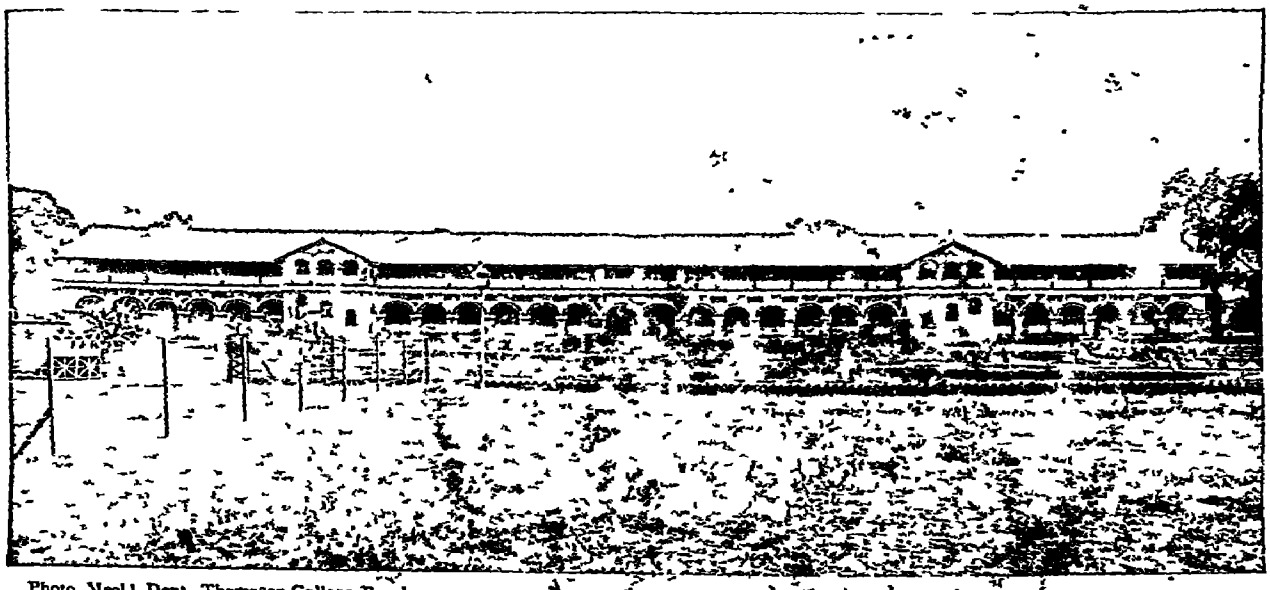


Photo Mech t Dept., Thomason College, Roorkee.

MAHDHAVA LAL RANCHHODLAL AHMEDABAD.

GOVERNMENT HIGH SCHOOL HOSTEL, LETPADAN.

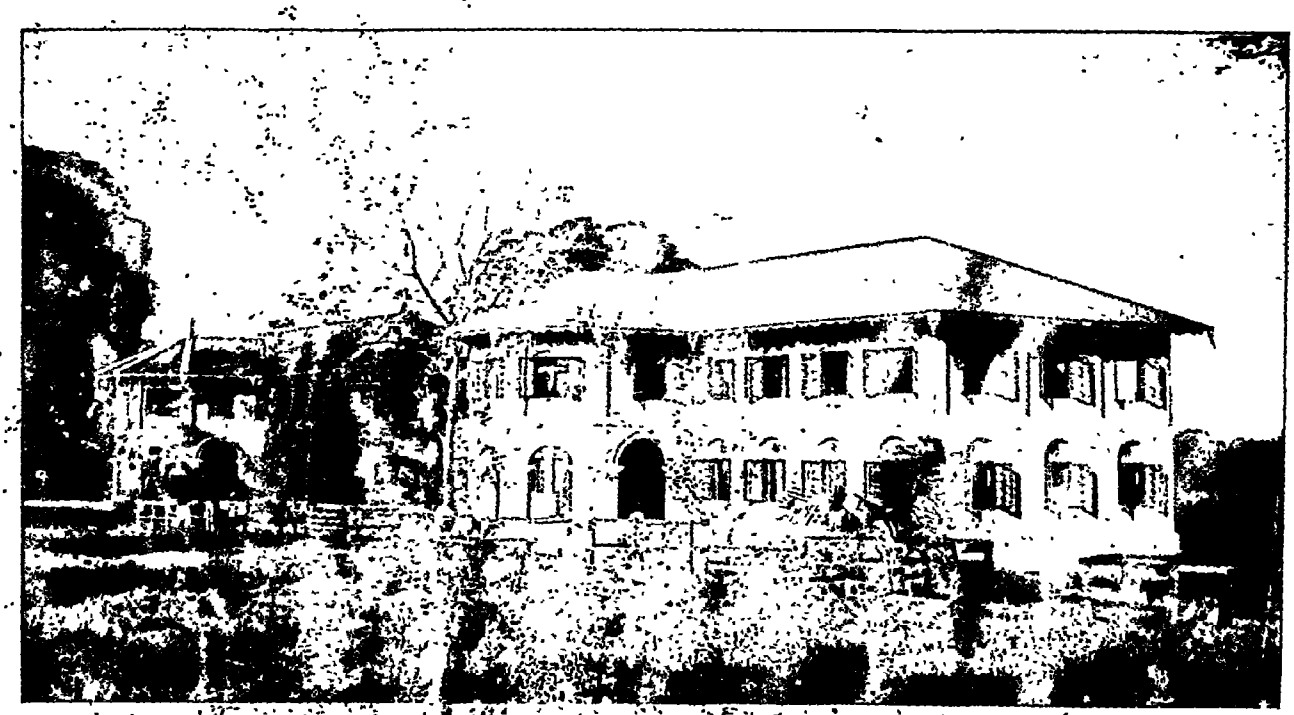
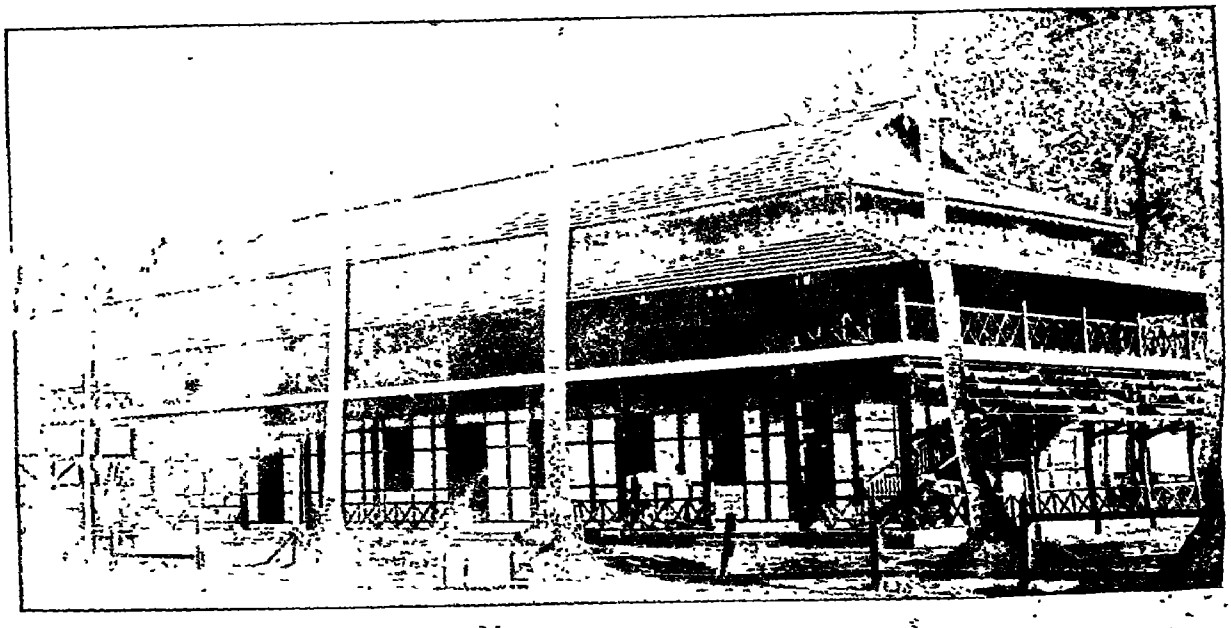


Photo: Mech. Dept., Thomason College.

HOSTEL OF A. [illegible] KA[illegible] HIGH SCHOOL, BASSEIN.



GOVERNMENT ANGLO-VERNACULAR MIDDLE SCHOOL, YANDOON.

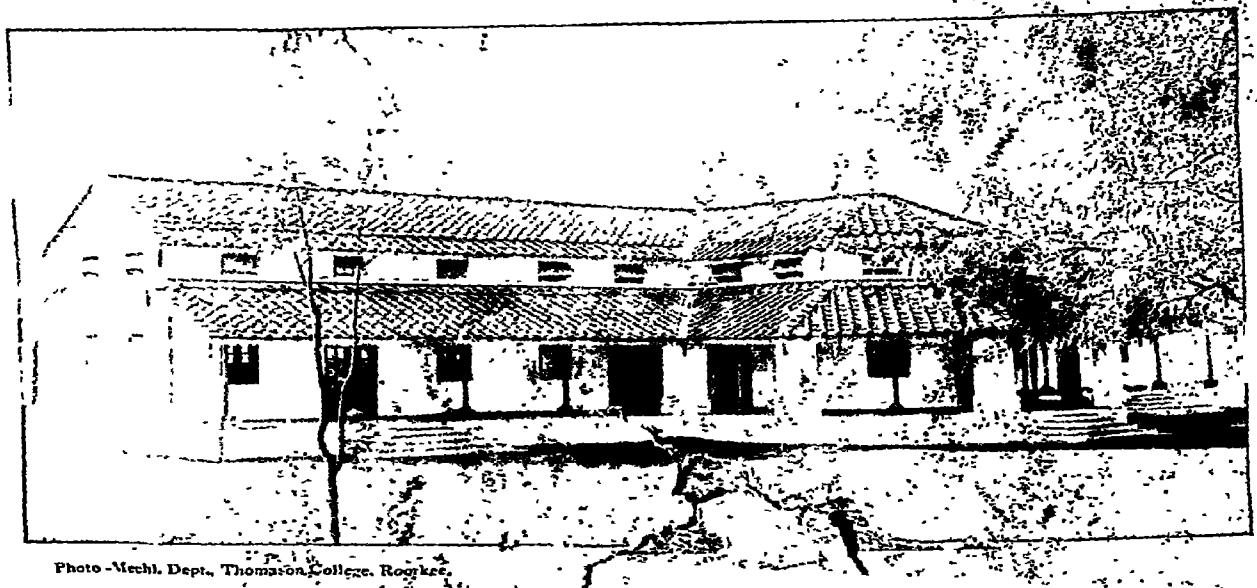


Photo -Mechl. Dept., Thomason College, Roorkee.

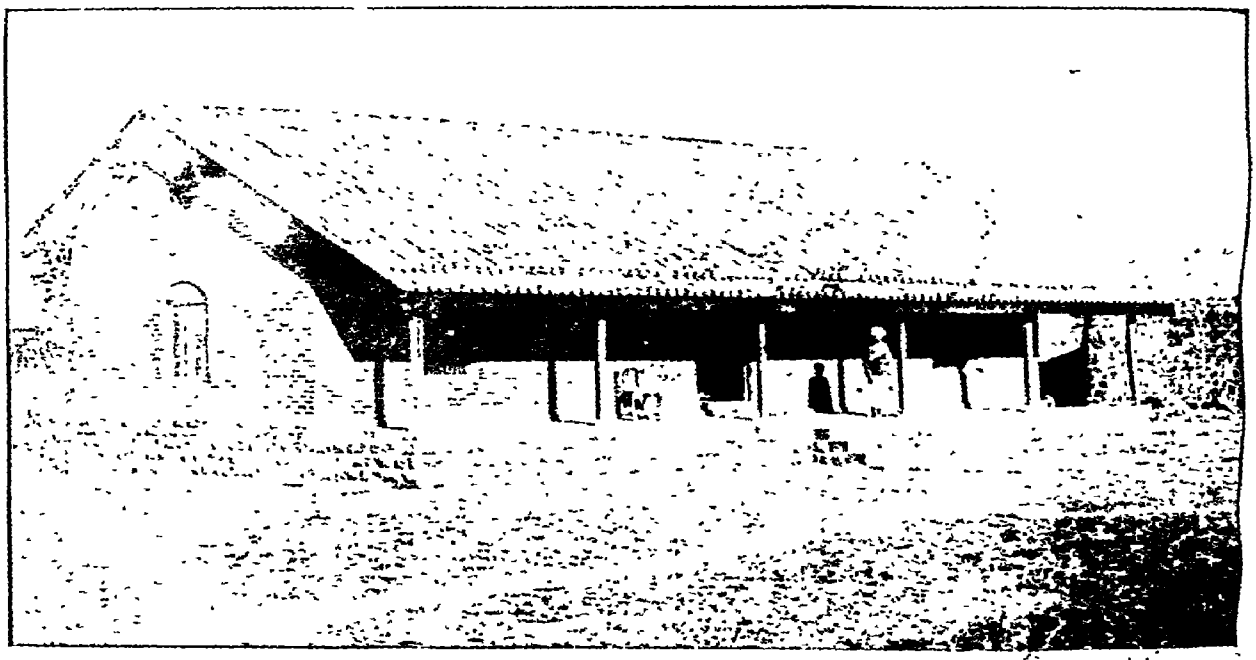
GOVERNMENT ANGLO- HOI

GOVERNMENT ANGLO-VERNACULAR PRIMARY SCHOOL, PEGU.

Photo-Mechl. Dept. Thomason College, Roorkee

HOSTEL OF A. B. M.

AY, SCI THOUSAND LIGHTS, MADRAS.

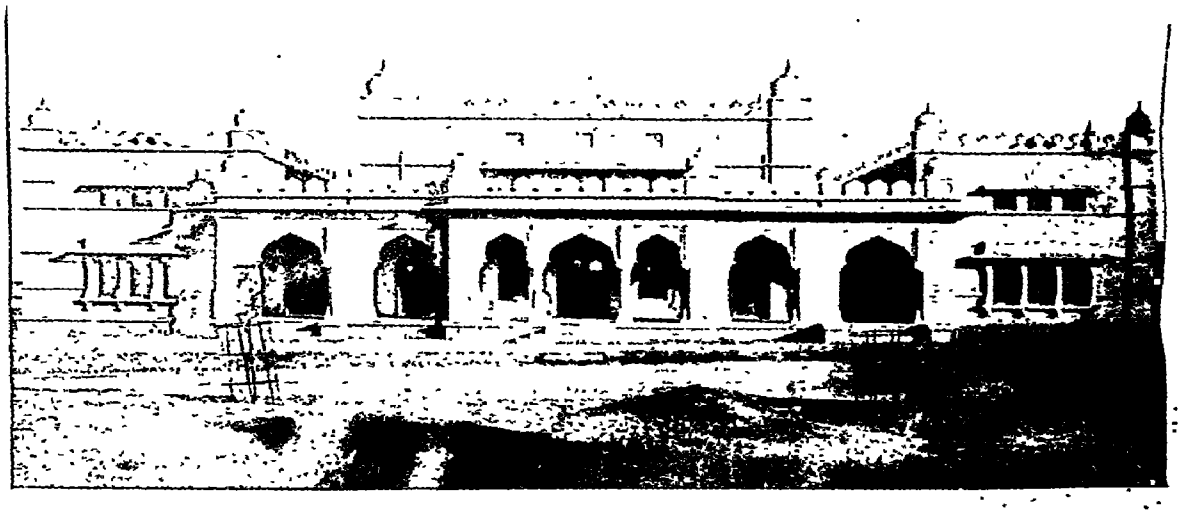


LOCAL BOARD PRIMARY SCHOOL, BUILDING AT AMNAPUR.

DAGARPARA UPPER PRIMARY SCHOOL, CUTTACK.

Photo.-Mechl. Dept.

EL OF A. B. SCNWARPET, COORG.



MUNICIPAL ELEMENTARY SCHOOL FOR HINDUS, BLACKPULLY, BANGALORE.

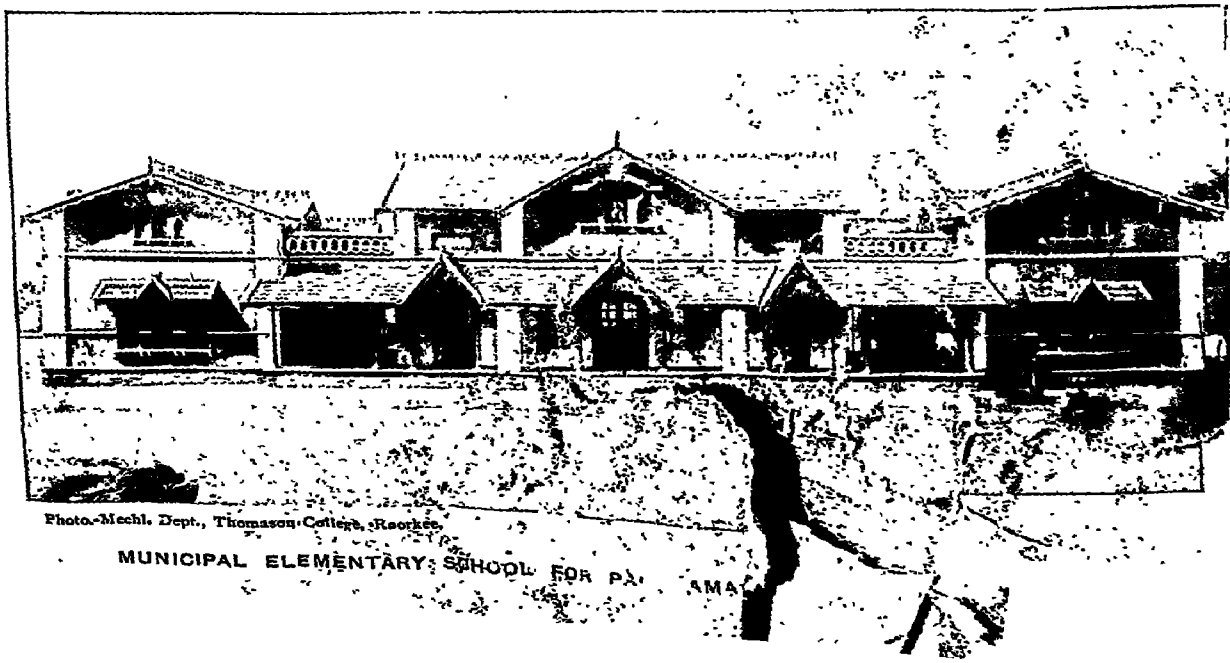
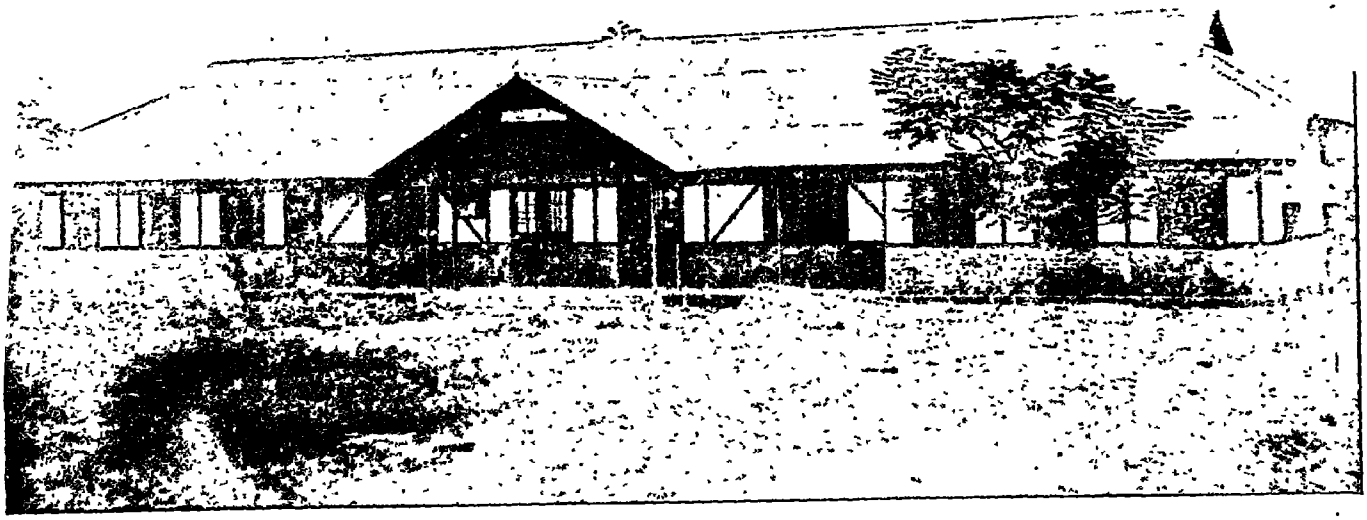


Photo.-Mechl. Dept., Thomason College, Roorkee.

MUNICIPAL ELEMENTARY SCHOOL FOR PA[illegible]AMA



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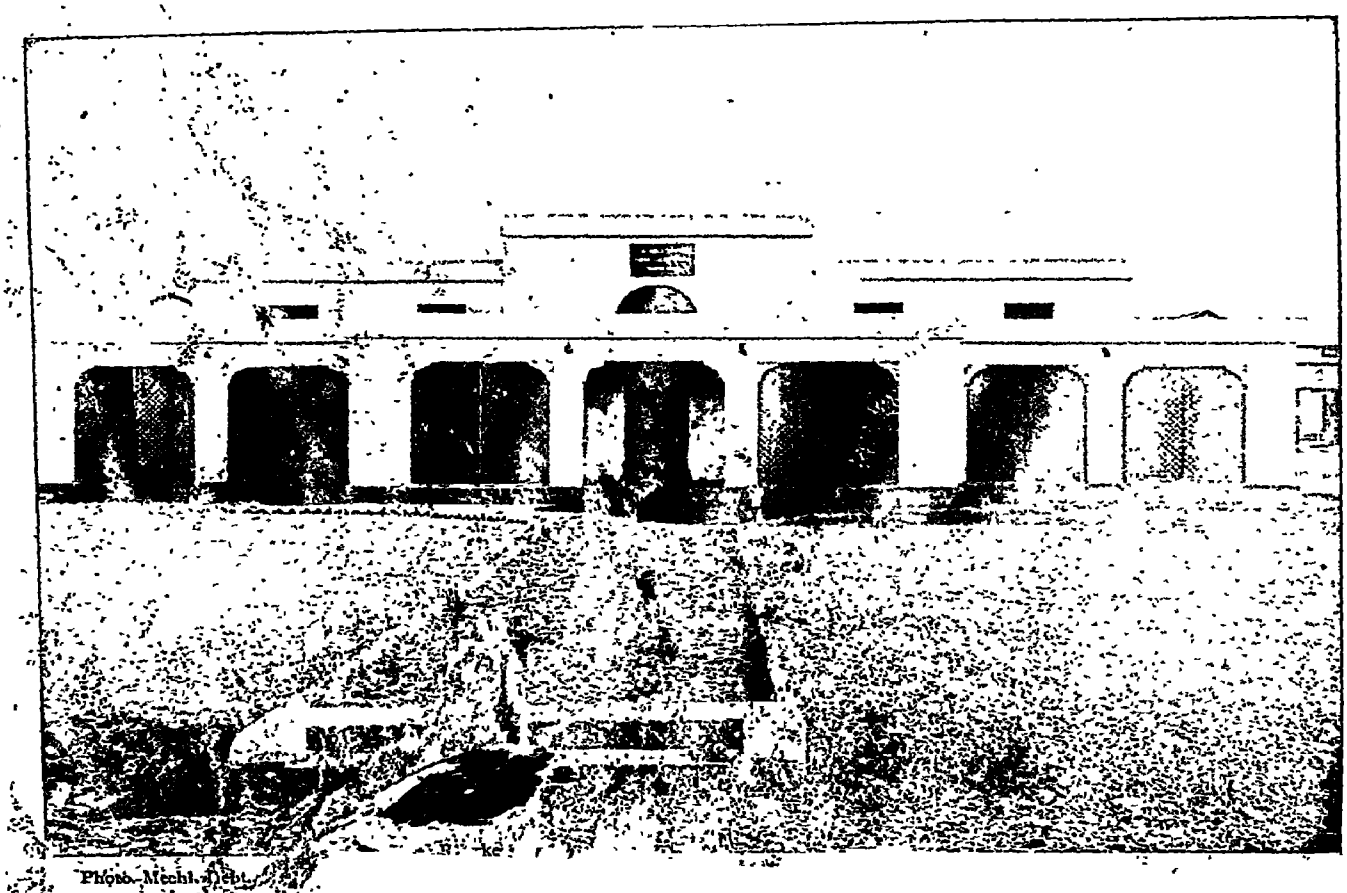
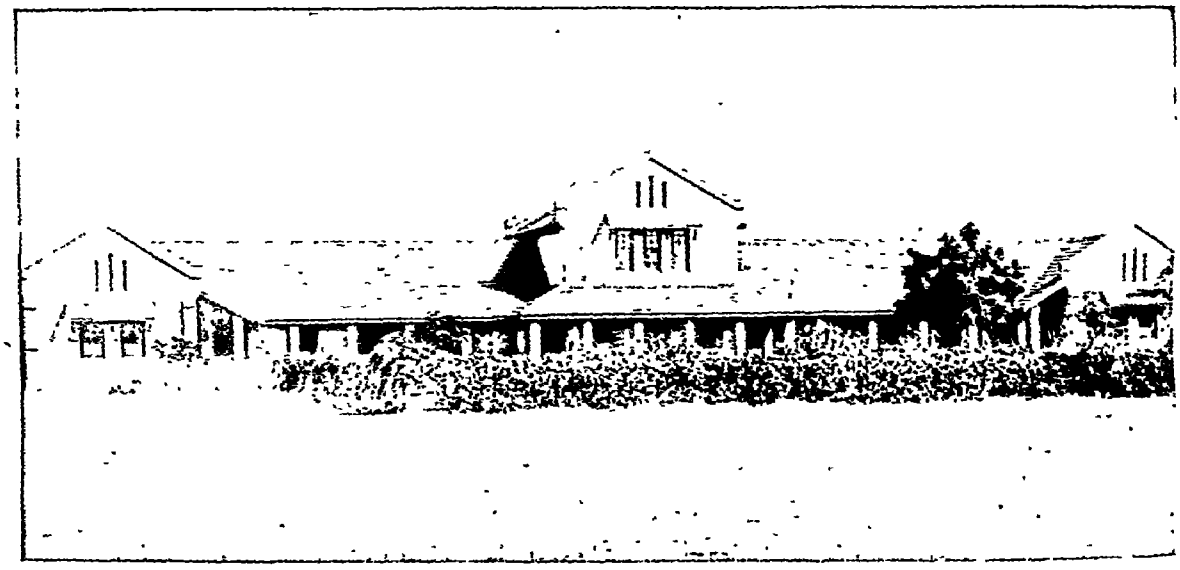
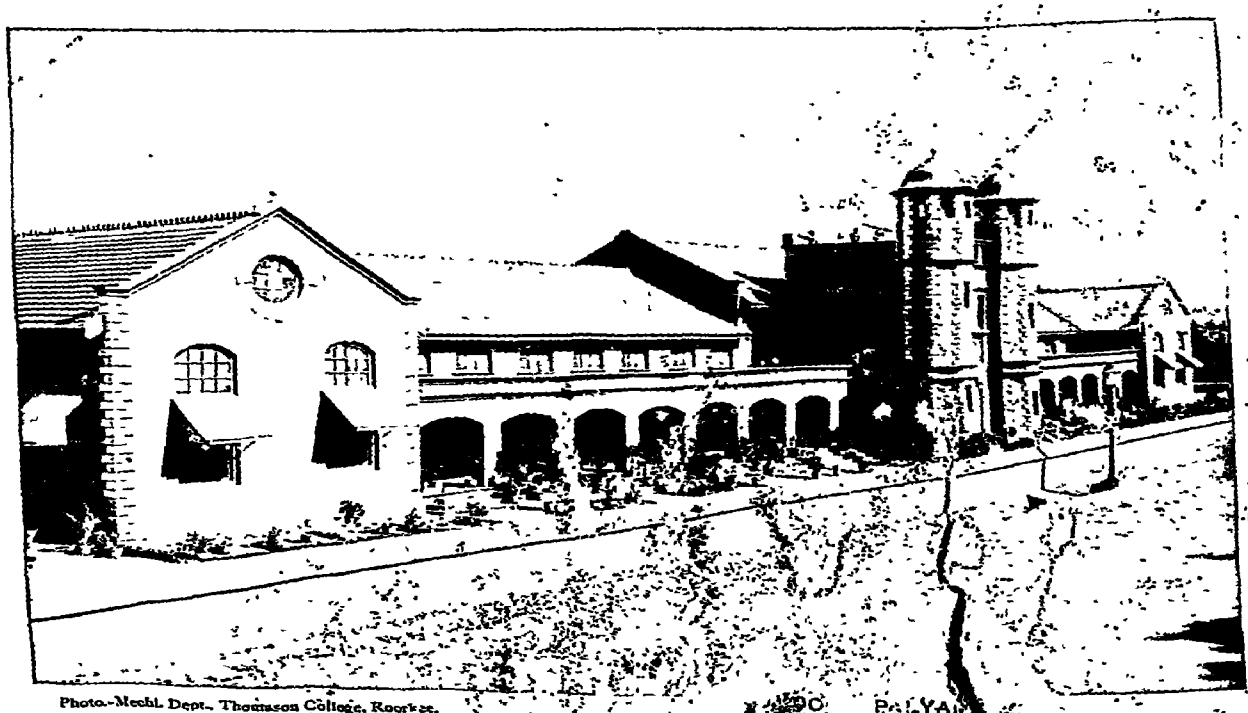


Photo. Mechl. Deptt.



S. P. G. TRAINING SCHOOL, NANDYAL, MADRAS.



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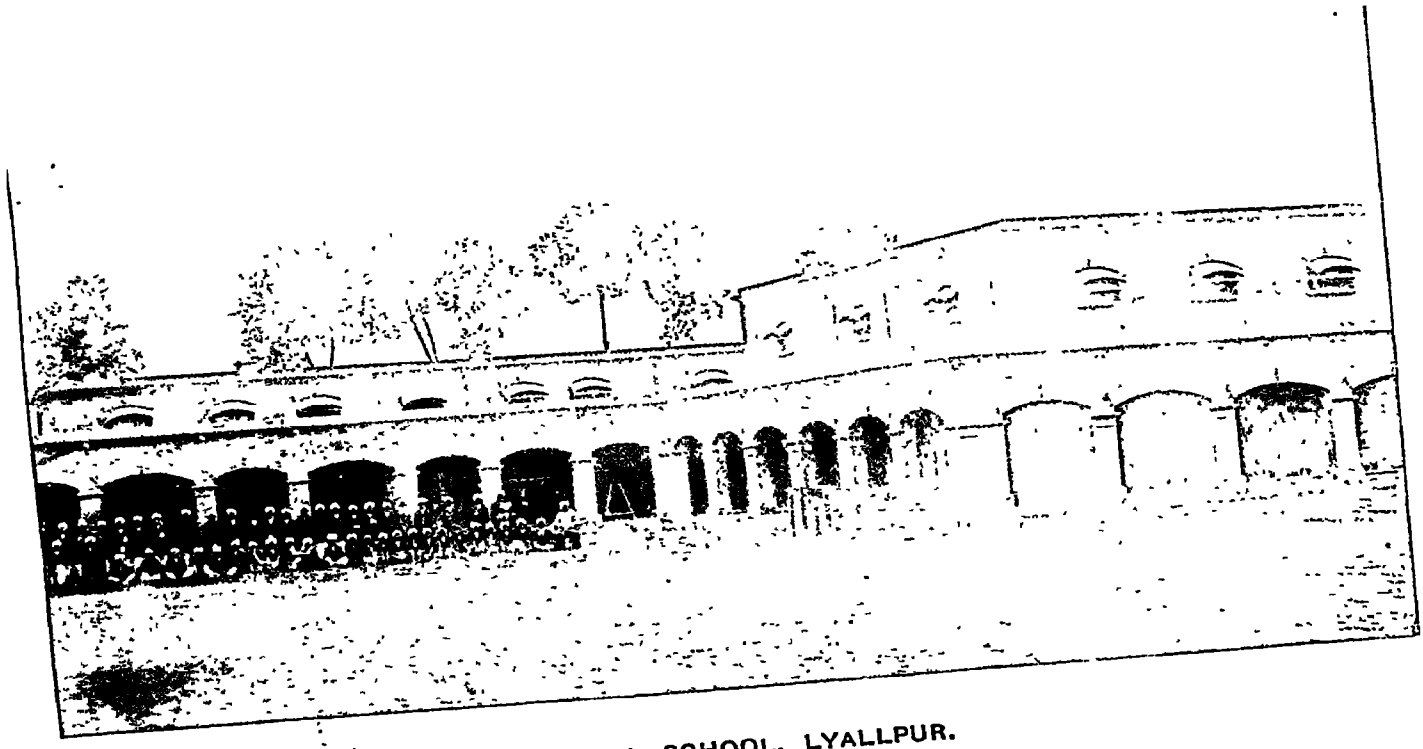
GLASS ROOMS, TRAI[illegible] PALYA[illegible]



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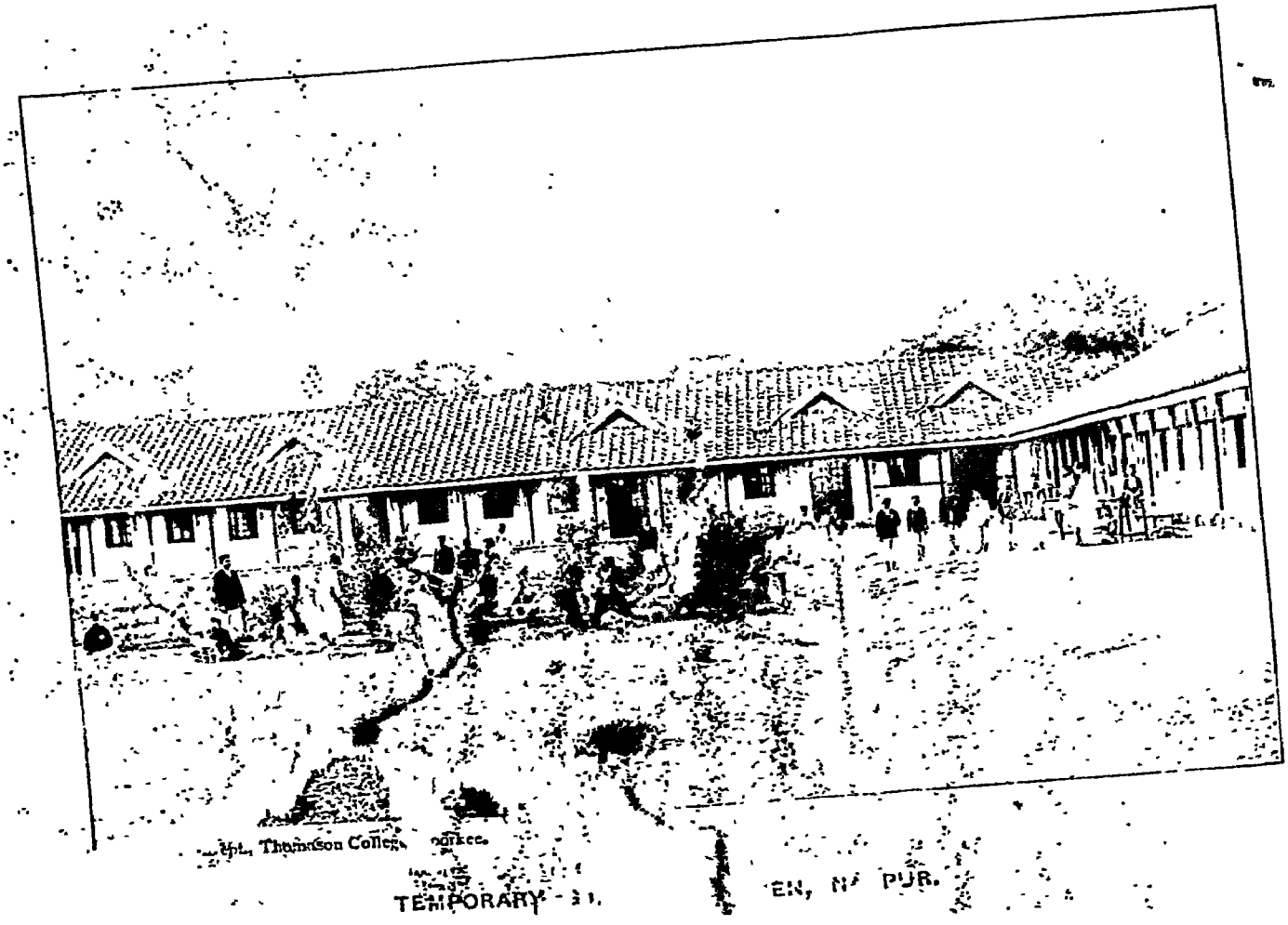
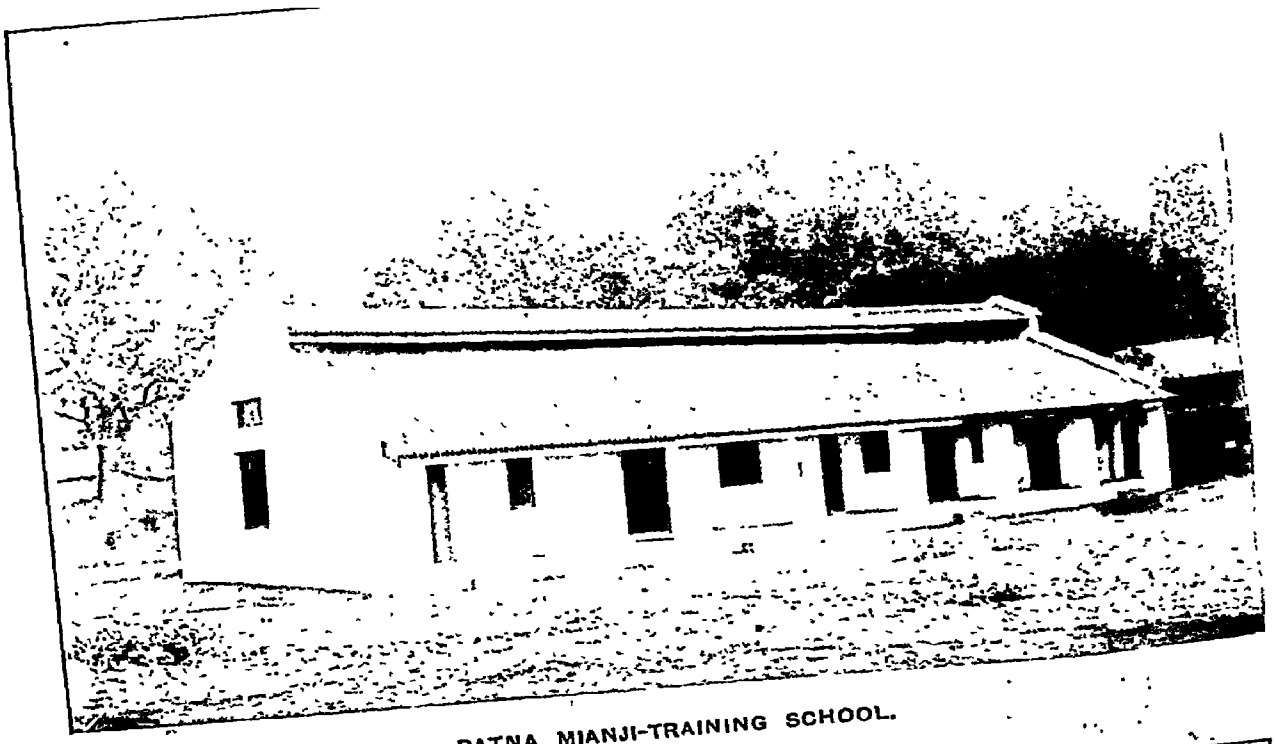


TEMPORARY - 31. EN, NA PUR.



PATNA MIANJI-TRAINING SCHOOL.

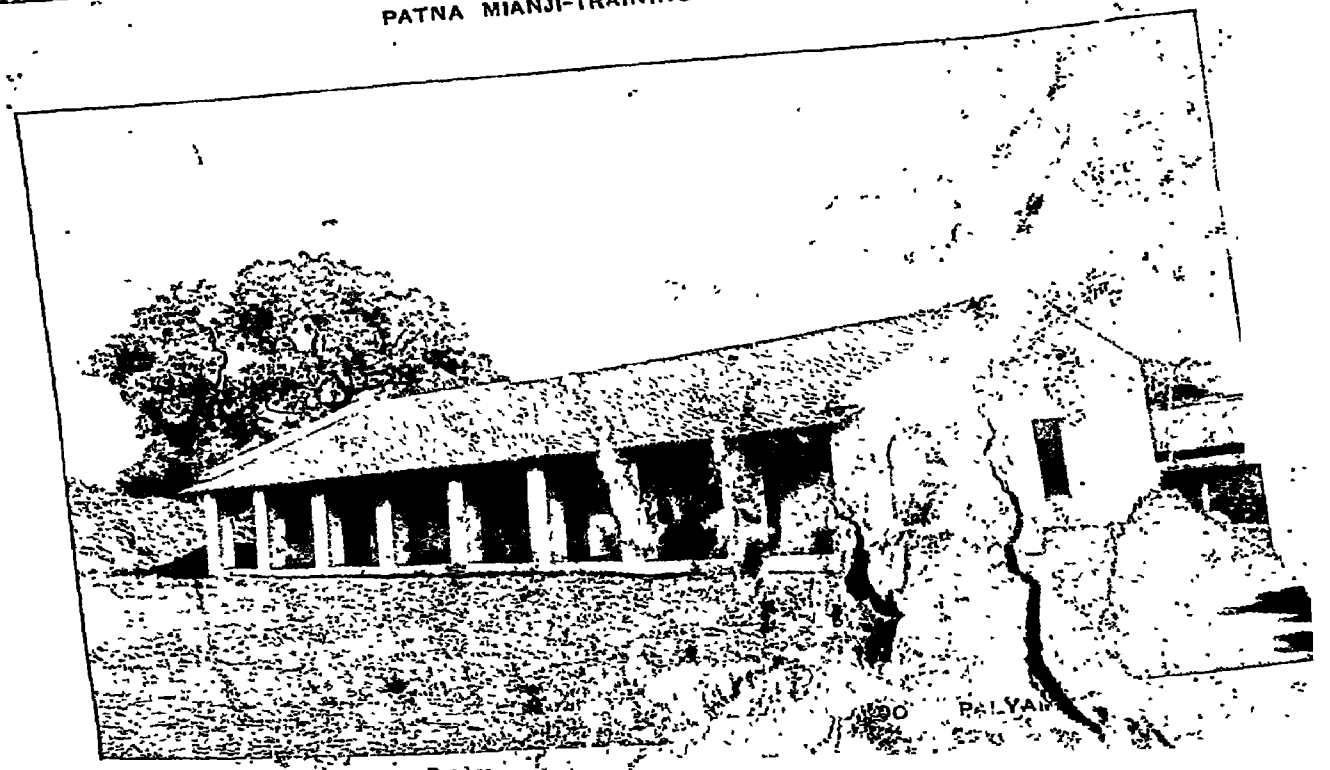
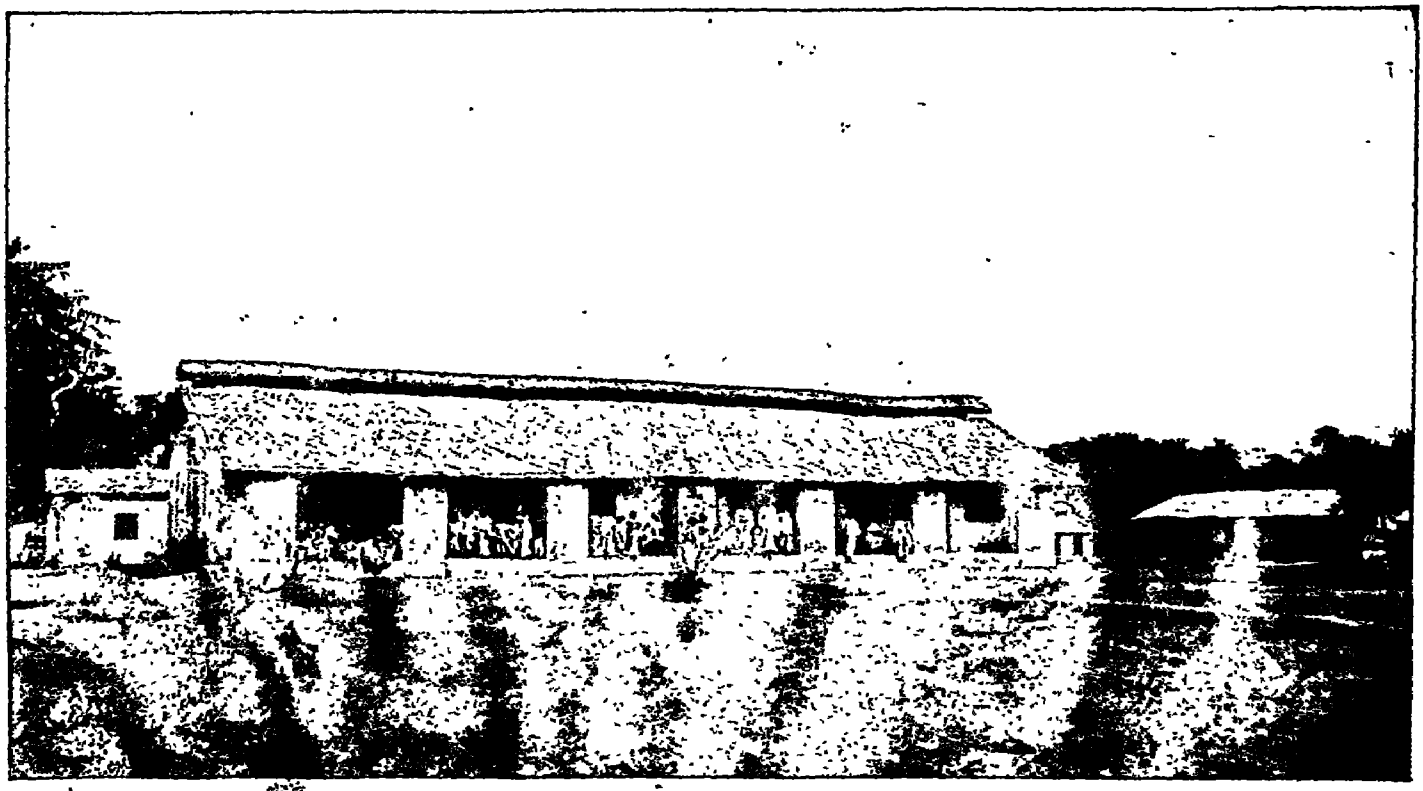


Photo-Mechl. Dept., Thomason College, Roorkee.

HOSTEL ATTACHED TO



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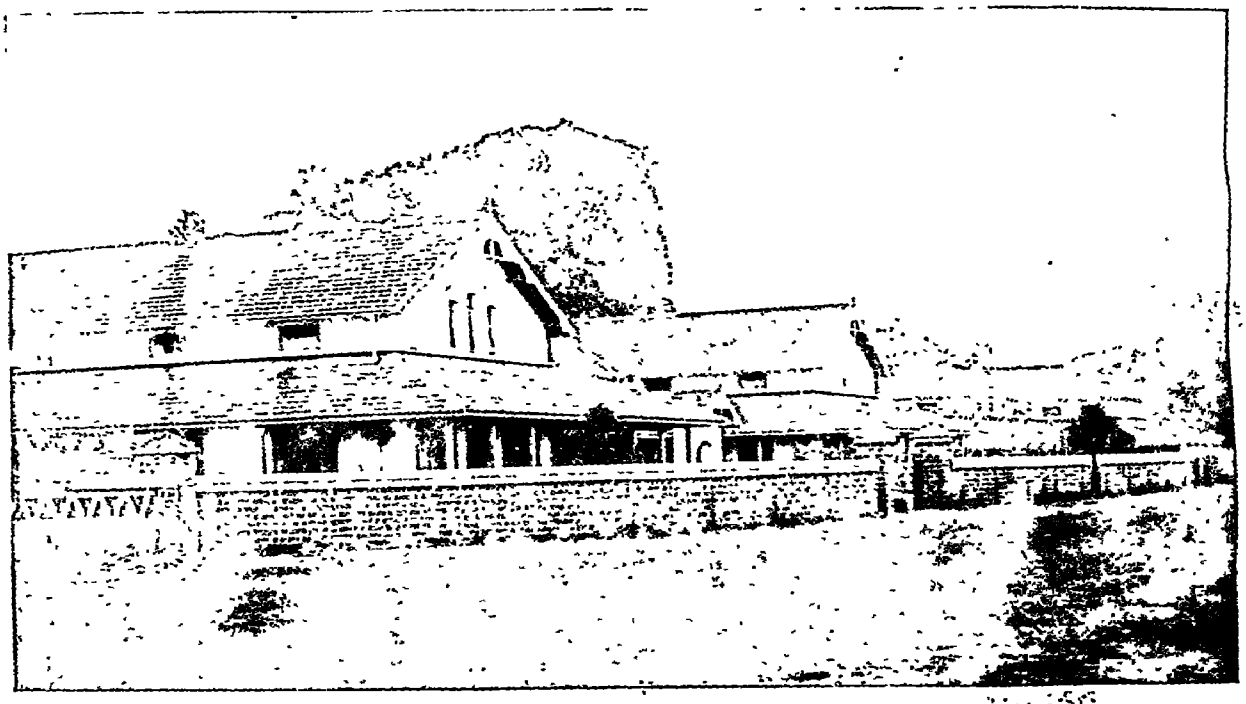
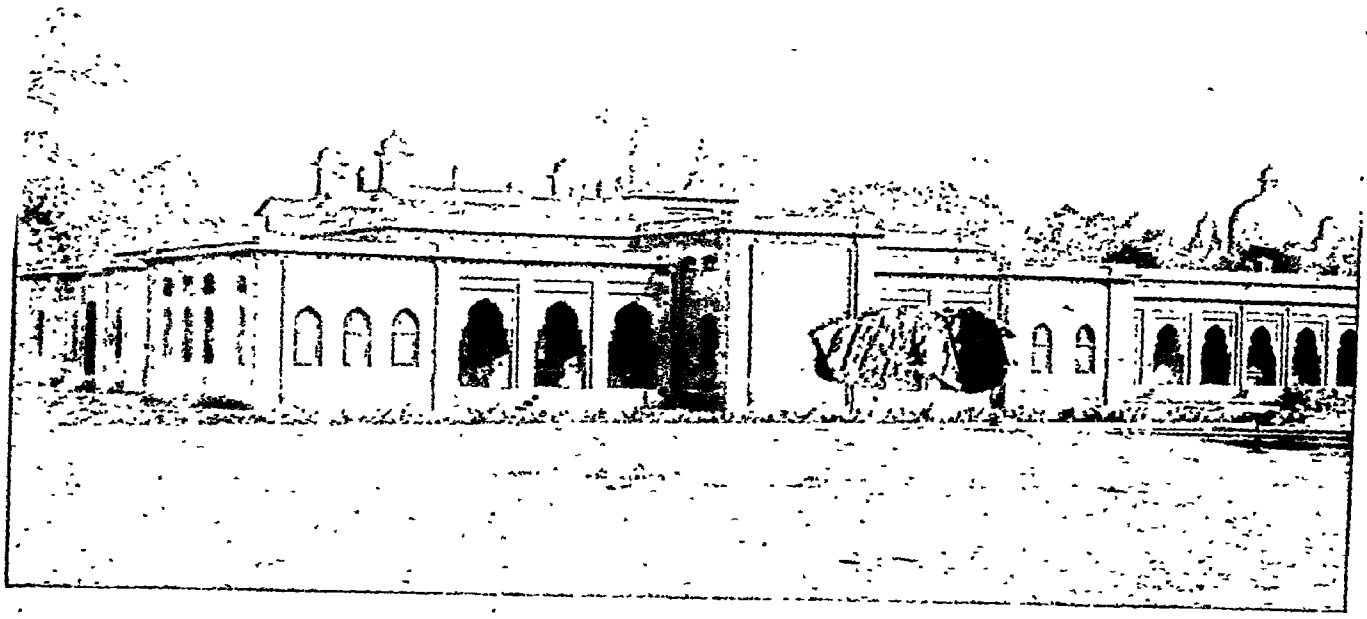
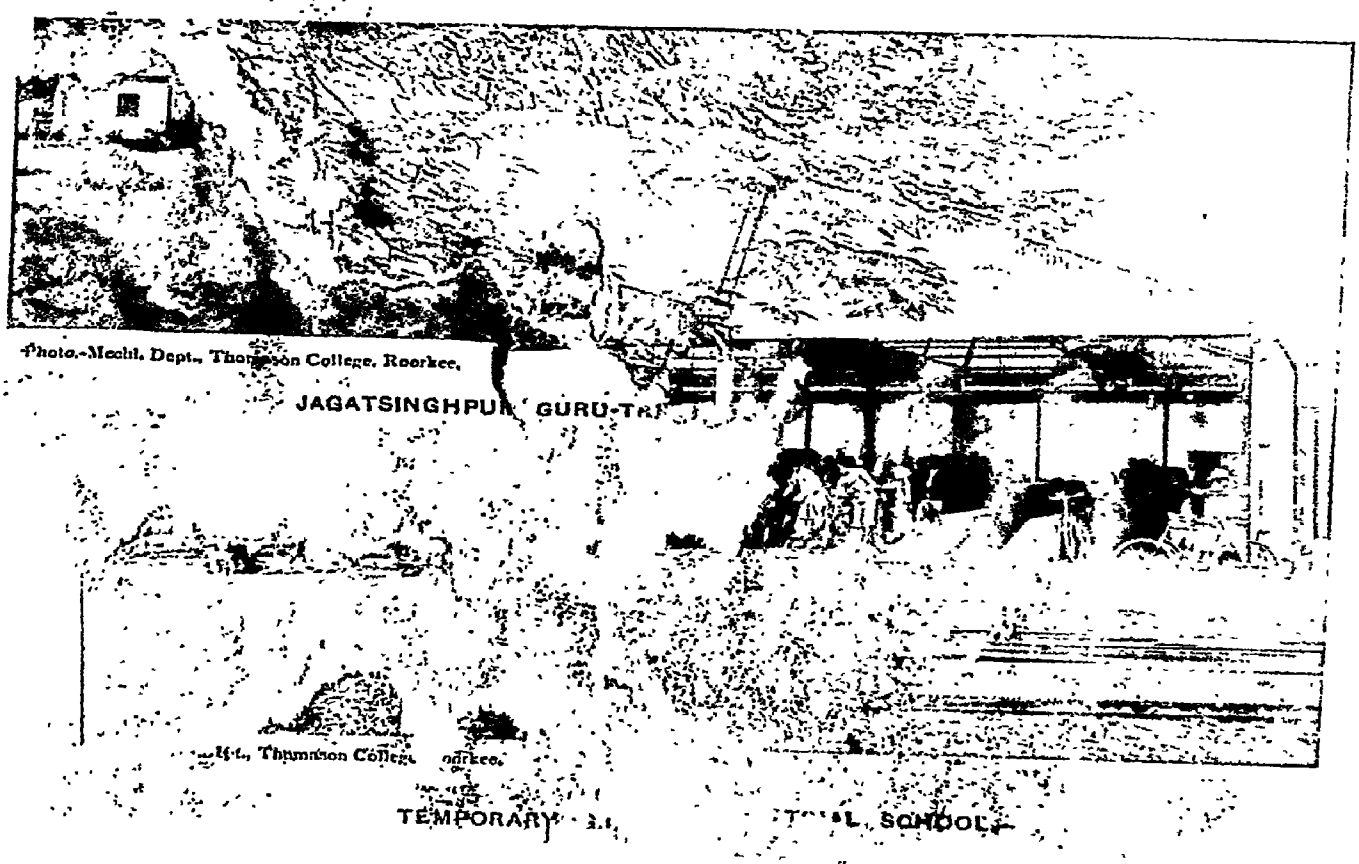
JAGATSINGHPUR, GURU-TRAINING SCHOOL, CUTTACK.



GOVERNMENT SCHOOL OF COMMERCE, CALICUT.



NEW WORKSHOPS, MAYO SCHOOL OF ART, LAHORE.



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JAGATSINGHPUR GURU-TRA

...l-t., Thomson College, Roorkee.

TEMPORARY ... L SCHOOL.

BOYS' ORPHANAGE, LAHORE.

Photo.-Mechl. Dept., Thomason College, Roorkee.

JAGATSINGHPUR GURU-TR[illegible]AND[illegible]HOOL, TOUNGOO.

Photo: Courtesy Depty Thomason Collection, Kidderpore

ST. THERESA'S, KIDDERPORE.

largely by reason of the increased number of trained Veterinary Staffs that were made available, increased provision of microscopes, and gradual perfection in the techniques of testing and treatment of this disease under active service conditions.

Mension may be made at this point on the subject of vector control. Generally speaking this was impracticable under the conditions that prevailed in most locations. Tabanidae swarmed everywhere and the monsoon brought with it indescribable plagues of day and night flies including mosquitoes. With the advent of D.D.T. however, the procedure was adopted, with regard to certain Veterinary Units, of spraying the surrounding jungle for a depth of 50 yards or so, also paddocks, posts, woodwork floors in stables and hospital buildings. It must be admitted that spraying with a 5% solution of this drug in kerosene did produce magical effects, and where it was regularly carried out one could in fact walk round mule lines without seeing any switching of tails.

(*b*) *Diagnostic technique and procedure.*—It was conclusively proved that the effectiveness of control was dependent on early diagnosis, early treatment, and wherever possible removal of infected animals before they could be a source of danger to others.

Detection of surra in its early stages was only possible by the examination of wet blood films under the microscope. Trypanosomes were frequently detected in animals which appeared to be perfectly healthy with normal temperatures.

Various blood testing procedures were enforced dependent on factors such as the time of the year, the degree of infectivity, and the location of units and formations with animals in relation to known Surra-affected areas. Where infecetd animal were found in the unit all animals would be blood tested daily for 15-21 days until clear. In other cases animals were tested for ten consecutive days at intervals of ten days. The minimum precaution adopted was to blood test all animals in a unit twice a week.

The usual technique of blood testing was adopted, that is to say, a sample of blood taken from a prick or small incision in the ear, was placed on a slide, covered with a coverglass, and examined under a 1/6th-power.

From experience it was found that trypanosomes were more numerous in the peripheral blood during the heat of the day than in the early morning or late after noon.

Literally millions of blood smears were examined by the Army Veterinary Services from 1942 onwards necessitating the formation of Anti-Surra Units in 1944, specially equipped with microscopes and mechanised transport to enable the high proportion of officers and Veterinary Assistant Surgeon on the establishment to operate simultaneously in various locations.

(*c*) *Treatment.*

I. By Antrypol

Factors.—Antrypol alone was almost exclusively used during the war for both preventive and curative treatment.

It was found that if treatment was commenced fairly early and provided adequate and exact dosage according to the animal's weight and condition was used, the intravenous injection of Antrypol would cure at least 90% of horses and mules infected with surra.

The problem of giving the exact dose of Antrypol involved an accurate assessment of the animal's weight. In the field, where suitable weighing facilities were of course not available the difficulty was solved by an ingenious method of weig t estimation devised by Lt. Col. G. PFAFF, M.B.E., R.A.V.C.

This was based on certain body measurements of the horse or mule (*i. e.*) the weight was estimated according to the formula, $\frac{G \times L}{5}$ = weight in pounds, or $\frac{G \times G \times}{300}$

APPENDIX II (4).

(*l*) 3 By Director Army Veterinary Services, (India)

1. INTRODUCTION

World War II has provided us with valuable information on the essential conditions necessary for the control of surra.

The knowledge that has been gained has accumulated from the experiences of the Army Veterinary Service operating in Burma where it was responsible for the health of some 35,000 animals—mainly equines—which were an integral and essential part of the transport organisation necessary to supply the Fourteenth Army including Guerilla columns of General Wingate's Special Force. These columns as is generally known, operated deep into Burma jungle and frequently penetrated virulent surra zones.

The Burma campaign therefore for the purposes of this paper, supplies a record of the endeavours we have made to control the ravages of this disease in its most susceptible sufferer—the horse and mule. Further information, however, on Surra in camels is also published at para. 3 concerning our present knowledge of the effect of Trypanocidal drugs on this animal. We have little information, however, to add in the case of cattle.

The story of Surra in World War II is to a large extent an account of the results obtained with the chemo-therapeutic agent, Antrypol (the British equivalent of the German product, Naganol).

This drug, produced by Imperial Chemical (Pharmaceuticals) Limited, chemically and pharmaceutically identical with Naganol, constituted our main armament against this disease. Much had to be learnt about its mode of use under war conditions where animals were required to move through some of the worst Surra-ridden area in the world.

Up to 1943 when Antrypol was adopted as a routine trypanocidal drug for surra our knowledge was confined to the results of trials with Naganol under the more or less static conditions in India before the war. These trials were first embarked upon in 1927 at Mona Remount Depot. In camels, however, the diagnostic and treatment technique with this drug was fairly well perfected by the outbreak of war, but this did not apply to equines, as between 1931-41 only 26 horses and 37 mules were treated for this disease. During the war years over 10,000 animals were treated for Surra. For example, between 1942-43, highest monthly incidence was 17 % of the total equine strength in Eastern Army.

Antrypol, however, was not the only drug to be used, though as previously stated, it was our main means of combating the trypanosome in the animal. Trials were made early in 1944 with Propamidine, Pentamidine and Stilbamidine. Of these three drugs Stilbamidine appeared to give the best results and it is now considered that this drug in combination with Antrypol may provide an effective answer to the toxicity factor which tends to develop with repealed Antrypol dosage, when the privations of war are encountered. Mention of Stilbamidine will be made later on in the text of this paper.

Nearly all that is described here is additional and supplementary to what has been already written in the Army Handbook of Contagious and Infectious Diseases in Animals (1945 re-edition).

2. SURRA IN EQUINES

(*a*) *Incidence.*—From the historic stand point it is interesting to record the effect upon the incidence of this disease which resulted early on from the lack of trained personnel available for the diagonsis and treatment of Surra. Largely in consequence of this, the highest monthly incidence of Surra between 1912-43 amounted to 17% of the total army equine strength in Burma. In 1943-44 this figure was reduced to 7 % and in 1944-45 still further to 2%. This improvement was brought about

The period between preventive dosage was fixed at 21-28 days, as during that period the elimination of Antrypol from the body at 0·4 grams per 100 lbs. takes place. Dosage at 0·3 grams per 100 lbs. as a preventive was tried but not found adequate to control the dsisease.

The dose recommended for adoption as a prophylactic was 0·5 grams per 100 lbs. repeated every 21-28 days, though in circumstances where the rest period after dosage was small and condition of animal below average the amount was reduced to 0·4 grams.

A minimum of 48 hours rest after a dose ;·4 was necessary to limit the onset of toxic symptoms.

The justification of preventive treatment was obvious. In one column of a long range group of Special force which did not receive prophylactic treatment, all animals developed the disease. Furthermore, records exist to prove that preventive treatment alone (where animals were already infected) enabled operations to be carried out without severe wastage of animals.

II. By Stilbamidine/Antrypol.

Trials with Stilbamidine dihydrochloride commenced early in 1945, but it was not utilised on a large scale at any time owing to the small supplies of the drug available and to insufficient trials under war conditions.

The results so far achieved are, however, hopeful, and its use may be indicated where treatment with Antrypol is contra-indicated on account of severe reactions to the drug.

It has been used in two ways :—

(*a*) *Alone.*—Dose 0·05 grams Stilbamidine per 100 lbs., injected intravenously daily, for 6 days.

(*b*) *In combination with Antrypol.*—On the scale 0·6—0·3—0·3 on days 1-8-15· The drug in doses of 0·05 grams has been given as a supplementary inoculation on days, 4, 5, 11, 12, 18, 19.

Precautions.—When giving daily injections of Stilbamidine, experience has shown that the animal tolerates the drug well after the 2nd day. The injection should always be given slowly and the first daily dose divided into two equal portions of 50 cc. solution, given at 30 minutes interval. Thereafter give as a single dose.

3. SURRA IN CAMELS

Late in 1944, a revised method of Antrypol treatment based on the weight of the animal was introduced. This involved a considerably increased dosage of Antrypol, but this step was considered advisable owing to numbers of animal having become blood positive to the wet film test after two 4 gram doses of the drug given at 14 day intervals. In a number of cases blood films showed trypanosomes within three weeks of the second dose of Antrypol. This led to the assumption that drug resistant cases of surra were occurring as happened in the case of mules in Burma.

As with equines, a weight formula was worked out, this being devised by Lieut. ORR, R.A.V.C. It was shown that variations in weight of the camel were considerable—from 900 lbs. to 1,500 lbs.

= weight in pounds, G being the girth in inches and L being the length in inches from the point of the shoulder to the point of the buttock. The formula $\frac{G \times L}{5}$ was used when the girth was over 60 inches, and the other when the girth was 60 or less.

To Lt. Col. G. PFAFF, M.B.E., R.A.V.C., is due much of the credit concerning the organisation of research work to perfect the dosage scales best suited for general prophylaxis and therapeutic treatment. Difficulties were not inconsiderable, particularly those in connection with deciding upon the safest and yet most effective preventive dose with which to inoculate animals undergoing the privations of the Burma capmaign.

Much of the experimental work was done at the Military Veterinary Hospital Lucknow. It was discovered that animals in Assam could not stand up to a dosage which produced no serious ill-effects in Lucknow.

Increased sensitivity to Antrypol was noticeable amongst debilitated animals and amongst those which had received previous dosage with the drug. A diet low in minerals, particularly calcuim, was considered to promote toxicity where Antrypol administration was in progress. The supplementary inoculation of calcium lactate in 15 gram doses by intravenous route from the day following Antrypol dosage was adopted in certain units, and was considered by some to have a beneficial effect and to reduce the severity of the toxic symptoms.

The war-time dosage for both equines and camels was considerably larger than that regarded as effective before the war. It was found that an insufficient dose of Antrypol was not only ineffective but could be dangerous, as the trypanosome was thus liable to become drug-fast thereby converting an animal into a dangerous reservoir of infection.

The first curative dose was designed to exercise the maximum trypanocidal effect compatible with the toxicity factor, and therefore was larger than the two subsequent doses of a normal course administered to an infected animal.

Curative Treatment.—The procedure usually adopted for the detection of Surra was to give an injection of Acetylarsan (20 to 25 cc.) to sterilise the peripheral blood stream (which takes up to 12 hours with this particular drug). The animal usually was wherever possible evacuated to hospital after this inoculation.

Antrypol dosage in veterinary hospitals was adopted according to the following scale: 0·6, 0·3, 0·3 in 10% solution on days 1-8-15 and the animal was discharged as soon as possible. Where treatment was given sufficiently early there was little oss in condition and it was sometime possible to discharge on the 22nd day.

Toxic symptoms were always liable to occur with this dosage. These included laminitis, Coronitis, excoriations of the anus, dermatitis and swellings on the girth area and muscular stiffness. To minimise the risk of development of these symptoms the procedure invariably was to turn animals loose in paddocks after inoculation and to ensure that they had free access to drinking water.

As previously stated, remedies were tried in an attempt to prevent the onset of toxicity. Intravenous calcium lactate was regarded as the best of the lot. It was observed that those receiving calcium tended to put on condition more rapidly than those that did not.

Preventive Treatment.—The use of prophylatic measures was not simple. An unpredictable number of animals, though not often more than 10% reacted severely to the test. This reaction occured in many cases with doses as low as 0·4 grams of Antrypol per 100 lbs.

The weight was estimated according to the formula :—

$$\frac{G \times L}{5} \qquad \frac{H1 \times H2}{5}$$

where :—G= Girth (first fold of skin behind chest).

L= Length (point of shoulder to point of buttock allowing cord to lie along the natural curves of the animal which must be standing square).

H1= Hump circumference measured round the base of the hump on a level with the dorsal spines.

H2=Hump across, measured from the circular measuring cord across the highest point of the hump and at right angles to the long axis.

The results of a number of tests which were cross checked on the weighbridge gave readings well within 100 lbs. of the actual weight. In most cases the weight estimate by measurement formula was below the actual weight :

Trials with increased dosages were carried out during 1944-45 in Northern Command under the supervision of Col. G. F. STEVENSON, O.B.E., D.D.V.S., Northern Command in close collaboration with Col. G. PFAFF, M.B.E., of G.H.Q.(I) who advised over the question of dosage.

Antrypol was used on the following scale ; 3 doses at 7 days intervals of 0·5 grams, 0·3 grams, 0·3 grams, per 100 lbs. body weight. The largest single dose given was 7·5 grams and this to a camel of 1520 lbs. weight. A camel of this weight received on the revised dosage over the same period 13·5 grams as opposed to 8 grams on the dosage scale in force in 1939-43. Similarly a camel of average weight scaling 1208 lbs. received a total of 10·8 grams. No toxic symptoms resulted on the dosage by the individual weight system.

SUMMARY.

It may be of interest to compare the scales of Antrypol dosage laid down during the pre-war and war time periods for curative treatment in camels :—

Date.	Animal.	Antrypol Dosage in grammes			Period between doses	Total dosage grammes
		1st dose	2nd dose	3rd dose		
1939	All camels	2	4	—	3 to 4 weeks depending on a positive blood film after 1st test.	6
1943	All camels	4	4	—	14 days	8
1944-45	Camel 1208 lbs.	6	2·4	2·4	7 days	10·4
	Camel 1454 lbs.	7·3	3·0	3·0		13·3

Safe guards.

The following rules for determining dosage were laid down during the War :—

(i) Blood positive — Full dosage

(ii) Blood negative
- Mercuric chloride test positive
- Clinical signs of surra present

} Full dosage

(iii) Blood test negative
- Mercuric chloride test positive
- Clinical signs of surra absent

} Initial dose of Naganol.

(c) *Cattle.*—Curative treatment involved a dose of 0·5 grammes per 100 lbs. of Naganol followed after 14 days by 0·25 grammes per 100 lbs. The weight was estimated from the formula $\frac{G \times L}{5}$

Tartar emetic was used for cattle and buffaloes, in view of its relative cheapness and efficiency in bovines. The toxicity of tartar emetic was found to be greatly reduced by dissolving the salt in 5 per cent. glucose solution instead of in water.

Dose—5 cc. of a 2 per cent. solution per 100 lbs; with a maximum of 50 cc. repeated after 5 days. The injection must be made slowly, and followed by the injection of a few ccs. of boiled water to clean the needle.

4. WHEN AN ANIMAL MAY BE REGARDED AS CURED

Horses and mules.—A relapse may occur several months after an animal has apparently been cured.

From the military point of view during war time the standard inevitably has to be lowered, and the practice, as hitherto stated, was to discharge an animal as soon as possible after the third injection of Antrypol.

This was not before the 22nd day and was subject to the animal being in reasonably good condition and passing the prescribed blood test.

The rule laid down in early 1943 that an infected animal, after the three curative injections, required to pass a daily blood test from the 29th to the 56th day, was relaxed without apparent bad results.

Conclusion.—The experience that has been gained in the knowledge of this disease and its treatment with Antrypol necessitates the recording of one all important factor regarding treatment.

The administration of Antrypol is no haphazard affair and good results depend largely on the devotion to detail of the Veterinary Officer. Experience in war has shown clearly that the weighing of Antrypol, preparing the solution, and determining the weight of the animal are such important factors that they should be done by the officer himself and not left for a subordinate to do.

It is hoped that this description about our experience of Surra in World War II may be of practical value to the Board of Agriculture and Animal Husbandry in India when the time comes for the enactment of any future civil legislation affecting the control of this disease in India.

APPENDIX II (4).

(c) 3. By H. K. Lall, B.Sc., M. R. C. V. S.

Assistant Animal Husbandry Commissioner with the Government of India.

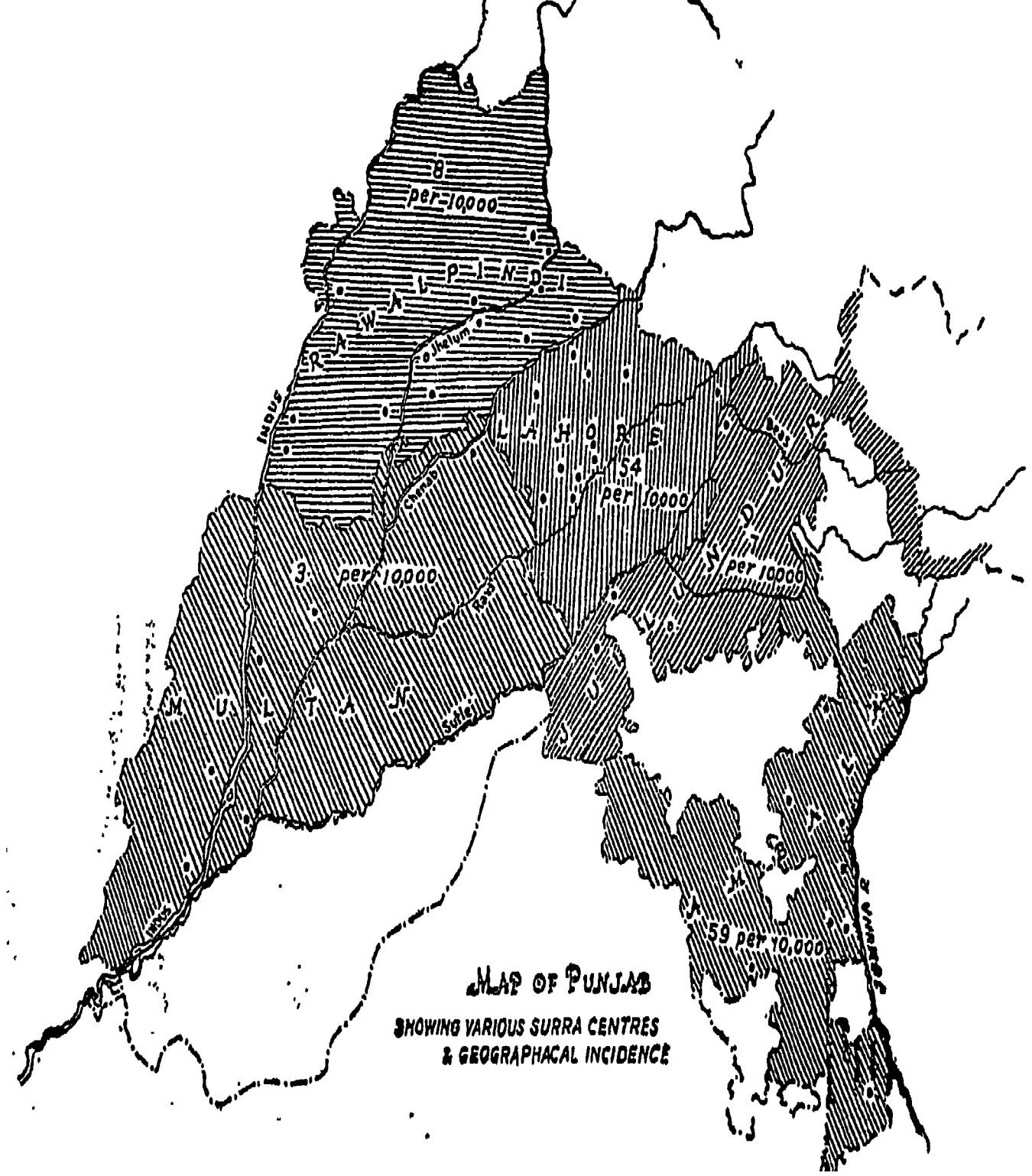
Basu (1945) collected the data concerning Surra in all species of animals under three headings, *i.e.*, bovines, equines and others from the year 1942 to 1944 from various provinces and States, showing the intensity of infection in the various areas. From his figures the Punjab seems to be the worst affected area, followed by United Provinces and Sind. In this note data for the last 14 years (1932—44) has been

collected from the various divisions of the Punjab (Lahore, Multan, Rawalpindi, Ambala and Jullundur) and an effort has been made to work out corelation between rainfall (the average of figures for last 14 years) and the incidence of surra, if any. The following table and the attached graph* (graph No. 2) indicate that there is no direct relationship between rainfall and the number of surra cases. The number of surra cases is more or less constant. *If anything there is a fall in* the incidence of the disease in heavy rainfall years. No doubt there is a seasonal occurrence of the disease, *i.e.* there is increase just after the rainy season, as can be seen from graph No. 2. The low incidence in heavy rainfall years may be due to the washing away of eggs and larvae of the insect vectors. The abnormal fall in the number of surra cases recorded in the years 1943 and 1944 is due to the fact that naganol was not available. This point is discussed in detail later.

Seasonal incidence.—The figures for each month for the last 14 years have been computed and the average calculated. It will be seen from the following table No. 2 and chart No. 2 that the number of surra cases start increasing in August and reach their zenith in October. The peak is reached in September in Ambala, Multan and Rawalpindi and in October in Lahore and Jullundur (see graph IIIA and Table II). The figures available for Assam and Central Provinces for the last 2 years also indicate a similar *seasonal curve.* On the other hand, in the seasonal curve drawn by Basu (*ibid*) on the basis of total figures, the peak is reached (in September) earlier than in our case (in October). The separate figures for horses and camels were available for Jullundur division only in which case a separate graph has been drawn (graph IIIB), which shows that the peak in the cases of the equines is reached in October and in camels in September. These curves are similar to those for 'Equines and Others' obtained by Basu (*ibid*). According to Basu the peak in bovines is reached in August, while from the data supplied by Zargar for the years 1940-1943 the peak in bovines in the Central Provinces is reached in September. This may be due to variable climatic factors such as earlier rainfall at one place as compared to the other.

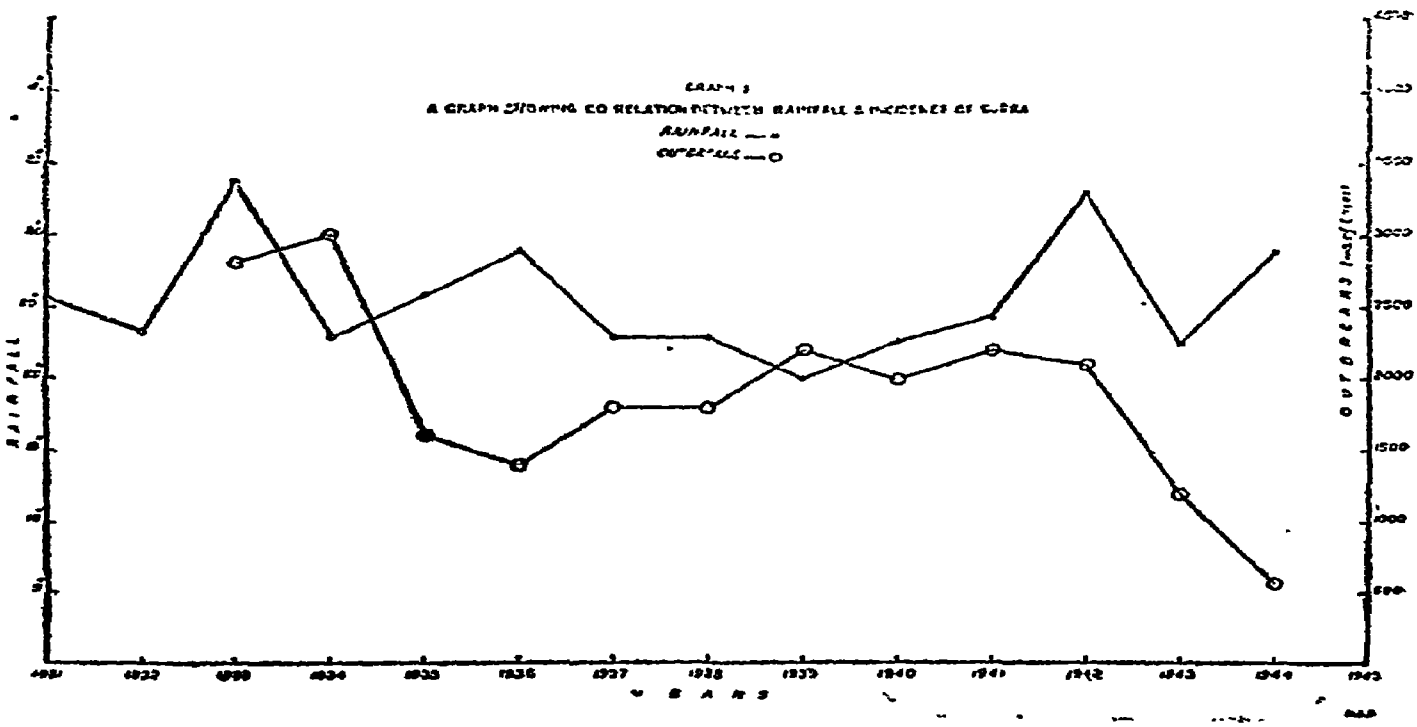
When the figures of incidence of surra are compared each year, it is seen that peak is reached in the same month each year with occasional minor variations. The average rainfall has also been worked out monthwise on the basis of the rainfall figures of the last 14 years and plotted against the number of average outbreaks each month. These figures show that surra has no direct relation to rainfall as previously stated but its incidence is increased in the months usually after the summer monsoon in the Punjab.

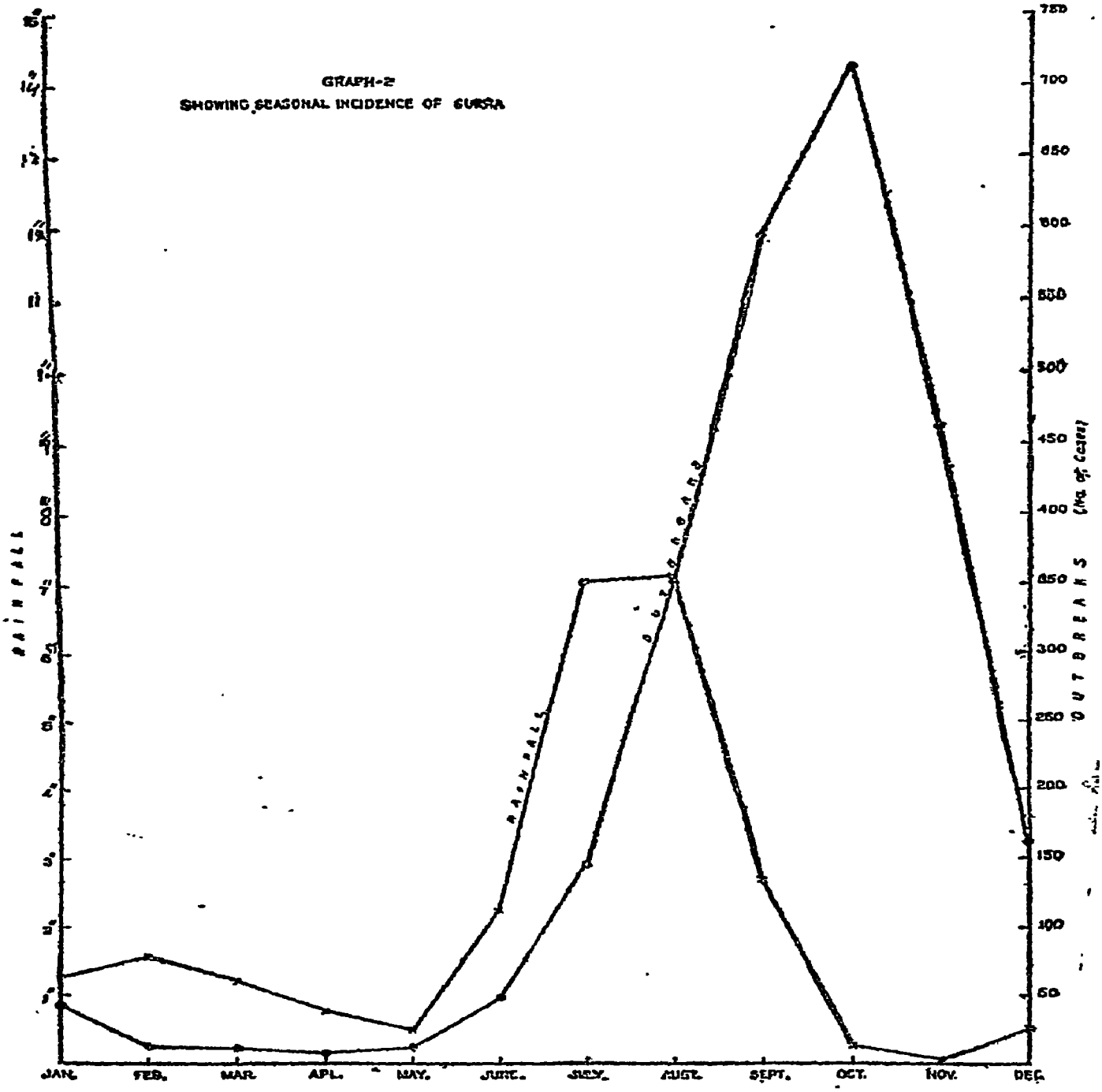
It is known that trypanosomes feed by osmosis on the glucose of blood which is naturally mobilised from the store, *i.e.*, the liver, and that there is hyperglycaemia in the early stages of trypanosome infection and hyperglycaemia in the latter stages when the trypanosomes usually disappear. Ray pointed out to the author that there is a seasonal variation in the blood sugar of equines. The seasonal incidence of the disease and seasonal varitaion in the quantity of blood sugar and the increase in the number of flies and other insects during the surra season throw some light on the epitozooloty of the disease. It seems from the histopathology of the disease studied on a few cases by Ray and Lall in 1944 (unpublished) that the lesions produced in chronic cases of surra are pathogonomics of sugar glycogen metabolic disorders and its further study—specially of the endocrines—is likely to reveal some useful information.

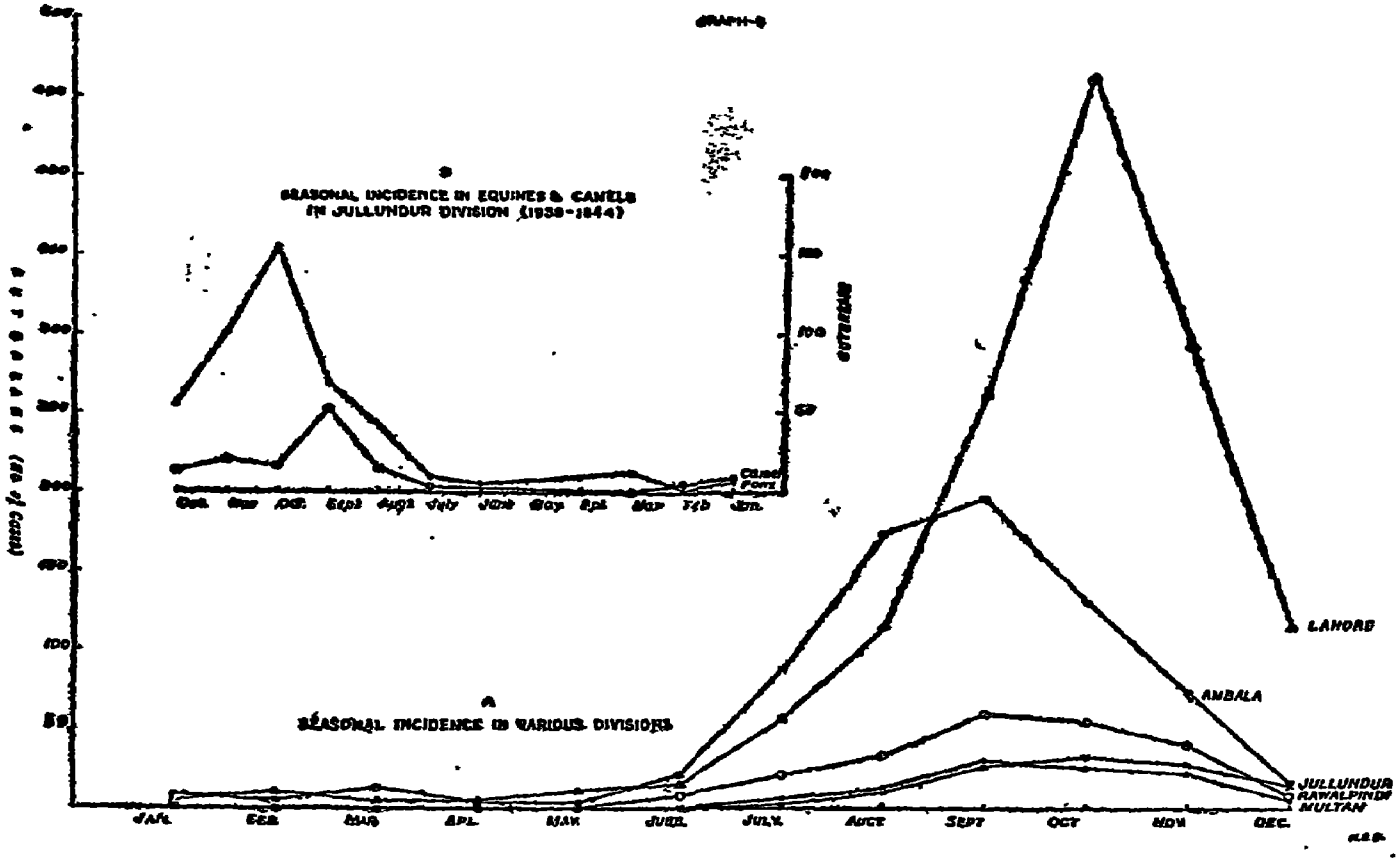


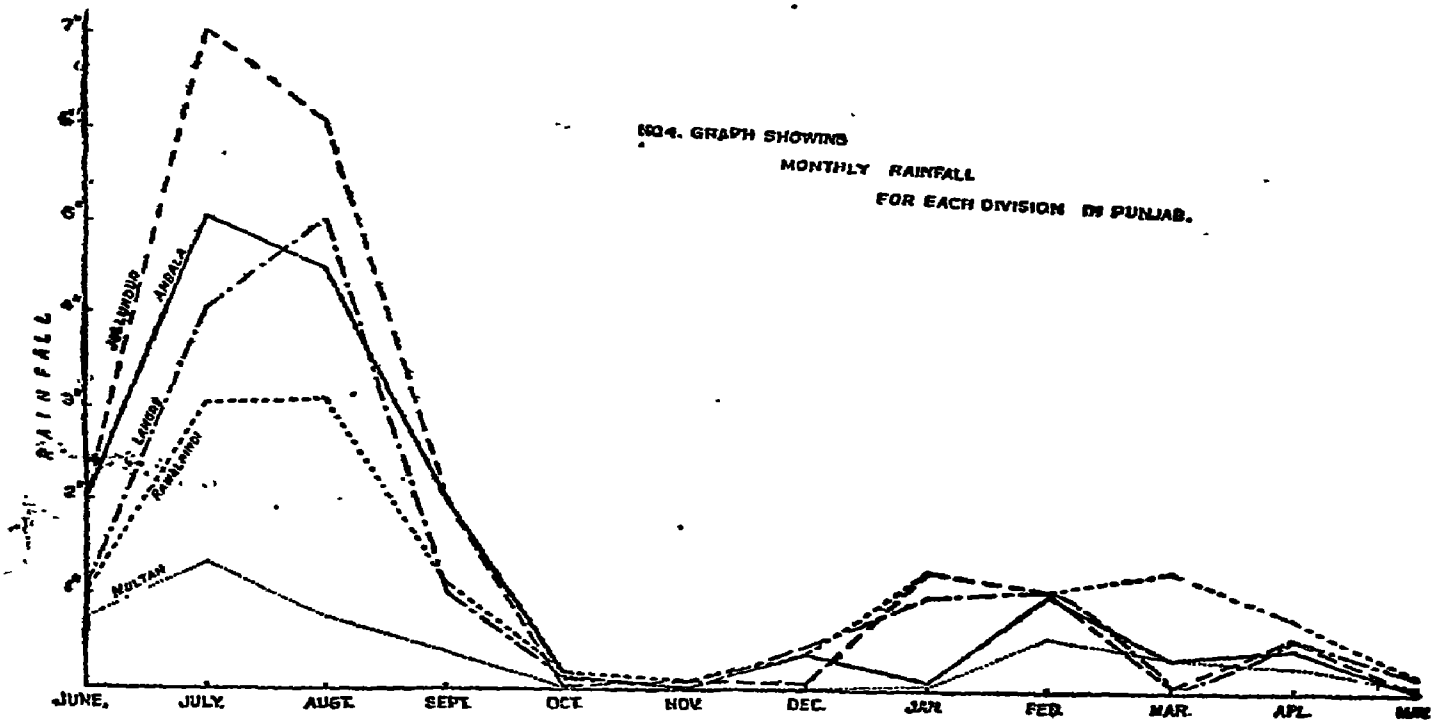
MAP OF PUNJAB

SHOWING VARIOUS SURRA CENTRES
& GEOGRAPHACAL INCIDENCE


RAIN FALL
OUTBREAKS
YEARS


GRAPH-2
SHOWING SEASONAL INCIDENCE OF SURRA
RAINFALL
OUTBREAKS (No. of cases)
JAN.
FEB.
MAR.
APL.
MAY.
JUNE.
JULY.
AUGT.
SEPT.
OCT.
NOV.
DEC.
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50





GRAPH SHOWING
MONTHLY RAINFALL
FOR EACH DIVISION IN PUNJAB.

Table I

The number of surra cases recorded and the average yearly rainfall in the Punjab 1932-1944.

Years	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945
No. of recorded cases of surra in the Punjab.	..	2,824	3,051	1,638	1,419	1,933	1,891	2,276	2,056	2,208	2,186	1,266	583	..
No. of recorded cases of surra in Ambala Division	..	..	..	..	..	977	702	773	1,191	593	1,362	435	258	327
Rainfall in inches	23·21	33·70	22·87	25·80	28·79	22·93	22·93	20·06	22·64	24·31	33·10	22·57	23·86	..

Table II

†Monthwise incidence of surra of each division of Punjab and average Monthly rainfall.

Months	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Lahore (average number of cases)	27·5	11·5	7·1	7·1	12·1	18·6	67·1	115·5	27·2	475·2	298	115
Rawalpindi	2·6	1·4	·36	·85	1·8	8·0	22·3	38·4	63·0	55·2	41·3	9·0
Multan	3·5	2·4	2·1	·57	·7	1·4	6·4	14·7	30·4	26·0	23·7	6·3
Jullundur	1·6	2·2	·8	·0	.6	·4	3·0	11·4	27·0	36·6	28·6	15·0
Ambala	8·6	5·6	12·2	9·4	9·3	21·2	88·5	173	195	130	67	16·4
Total	43·8	23·1	22·56	17·92	24·5	49·6	187·3	353·0	387·4	723·0	461·6	162·2
Rainfall	1·27	1·57	1·21	0·79	0·50	2·25	7·07	7·15	2·70	0·28	0·07	0·52

*The figures indicating surra incidence for Ambala division have not been included in this graph.

†Average is based on the figures of years 1933—44 in case of Lahore and Rawalpindi 1937—45 in case of Ambala, 1937, in case of Multan, and 1935—44 in case of Jullundur.

Geographical distribution.—A comparison has also been made on a geographical basis, *i.e.*, the number of outbreaks per total equine and camel population have been examined in the various divisions of the Punjab, having different climatic conditions and rainfall. The number of surra centres, most of which are along the courses of the rivers, varies in each division (see the map). This may be one of the reasons for variance in figures, but the analysis of outbreaks for each centre also shows the same result as obtained on the basis of average population. It will be seen from Table II that the number of cases are fewer in the ary climate of Multan as compared to that of Ambala and Lahore where the climate is more humid and there are extensive low lying areas. The last factor seems to be the deciding factor, as far as surra is concerned. The total rainfall in Lahore and Rawalpindi and Ambala divisions is approximately the same, but there is a difference in the number of cases on the (everage basis per 10,000 heads of equine population) in each division. Jullundur, having much heavier rainfall, has more or less the same incidence as Rawalpindi. The peak is reached in October in Lahore and Jullundur, in September in Ambala, Rawalpindi and Multan (See graph 3A). This is very probably owing to the larger camel population in these divisions, because in the case of camels peak is reached in September. in Ambala, having proportionately large camel population. It is noticed from the records that the majority of the surra infected animals brought to hospital were camels. In the divisions where the camel population is considerable in proportion to equines, the peak is not well defined. It is seen from the monthly rainfall curves (the average of 1935—1943) of the various divisions (see graph 4) that the highest rainfall is in July in Ambala, Jullundur and Multan and in August in Lahore and Rawalpindi. There seems to be no obvious connection between the earlier period rainfall and the peak period. Winter rainfall due to winter monsoons is maximum in Rawalpindi. It would seem, however, that winter rainfall has no corelation with the incidence of surra.

TABLE III.

Geographical Incidence of Surra in the Punjab.

Divisions	No. of surra centre in each division	Total number of out-breaks	Average No. of outbreaks per year	No. of cases per centre	*Population of equines (Horses, donkeys and camels)	Average No. of outbreaks per 10,000 animals)	Average rainfall in inches (1931-44)
Lahore (1939-44)	10	7,678	1,280	128	E 221732 C 13,417	54·4 (54)**	24·47
Jullundur (1939-1944)	4	634	106	26·5	E 91,349 C 54,651	7·2 (7)	44·21
Rawalpindi (1939-1944)	13	1,589	265	20·5	E 278,941 C 54,317	7·9 (8)	23·29
Multan (1939-1944)	6	674	112	18·6	E 302,604 C 113,415	2·7 (3)	8·47
Ambala (1939-1945)	8	4,354	726	90·7	E 83,842 C 40,202	58·6 (59)	26·66

E - Equines. C - Camels * 1940 Punjab Census Report.
** Bracket figures have been shown in the map.

The effect of chemotherapy on the incidence of surra.—In the early part of disease investigation schemes extensive trials were made by the field staff of the province with tartar emetic, naganol alone and both combined in the treatment and prevention of surra. But, as late as 1936, Taylor, Director of Veterinary Services, Punjab reported that the treatment of equine surra with naganol was not an unqualified success In 1940 Walker reported that surra in horses could be cured both by naganol alone and the naganol cum tartar emetic method, provided treatment was applied in the early stages of the disease.

Tartar emetic, which was commonly in use for the treatment of camel and equine surra, gradually was replaced by naganol in the case of equines, but in the case of the camels its use remained circumscribed due to its high cost. In bovines, however, it has been successfully used as a curative and prophylactic in the United Provinces where it has been tried in the years 1939-45 on a fairly large scale in a limited area, while successful curative effects are reported from Hyderabad (1944-45), Madras (1941,42, 1943, 1944) and Assam (1943-1944 and 1945). From Orissa (1940-41 and 1942) however, the results of treatment of bovine surra with tartar emetic were not so convincing; symptoms of shock were noticed in some of the treated cases, while some animals succumbed to the disease in spite of the treatment. In one case from Madras also ulticarial eruptions and symptoms of distress were noticed.

Neganol became very popular as a curative remedy in surra because of the single injection rquired ; second injection being necessary in a few cases only. From the reports of the Disease Investigation Officers for 1939 to 1945, it seems that naganol has been successfully used as a curative in all parts of India. The prophylactic value attributed to it, however, can be taken with reserve because of the lack of controls in most of the experiments undertaken. The supply of the drug became limited during the war and the stock in the country was nearly exhausted by 1942 when it was being sold at the exorbitant price of Rs. 50 a dose so that only a few race horse breeders could afford. Since then (1942) there has been an enormous reduction in the recorded number of cases of surra in the various hospitals in the Punjab as can be seen from the graph and according to the information from the various individuals working in the hospitals. This reduction is a psychological phenomenon. The clients having got accustomed to single injection treatment of naganol, were not naturally inclined to revert back to tartar emetic which in most of the cases, necessitated more than one injection and even then there were chances of relapse occurring.

Antrypol came into use during the war. It has been successfully used in treatment as well as in prevention of surra on a large number of horses in Assam during the years 1942, 1943, 1944. In 1943-44 in Sind, in 1944-45 in Kashmir, good results were obtained by its use in camels ; in Sind the groups of the camels injected with antrypol remained free from the disease. In the Central Provinces, however, in 1945-46 extensive ulticarial eruptions lasting for 12 hours were reported as the after result of antrypol treatment in the only case treated. The details of experiments tried at the Imperial Veterinary Research Institute and Punjab are not available.

Recommendations.—1. As a study of the relevant records in the Punjab points to the fact that there is no quantitative relationship between the incidence of surra and the annual rainfall, but that the incidence of the disease always increases after rainfall, prophylactic treatment might be confined to one or two months following the monsoon. New insecticides, such as D. D. T. should be used in the control of vectors during that period.

2. As the decline in the number of surra presented for treatment followed the cessation of the use of naganol, it appears that owners will forego treatment rather than submit to one which causes some inconvenience, it, therefore, follows that simplicity of treatment should take precedence over the ultimate total effectiveness of the treatment or should at least be considered as equally important to it.

3. A more intensive study of the physiology and histopathology of surra is advisable.

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APPENDIX II (4).

(d) By Mr. H. S. Bawa, M.R.C.V.S., Director of Veterinary Services, Sind.

Since the advent of naganol (Bayer 205) in 1928 by Edwards as a remedy for Surra in India, the veterinarian has been in search for the solution of several subsidiary points before being inclined to close the chapter of conquering animal trypanosomiasis. The most important of these is Simplification of the technique and the cleansing of the system of these parasites in cases of long standing, particularly in equines, for, relapses inspite of the treatment are not uncommon. Early cases no doubt respond to naganol treatment satisfactorily but when the disease is of sufficiently long duration breakdown is likely to occur. To this end Taylor (1934) recommended a long course (about one month) of treatment with naganol and antimony tartarate. He claimed better results with this treatment. Curiously enough Surra in other animals such as camels, cattle and dogs can be combated more easily with either naganol or antimony tartarate.

Soon after the outbreak of the last war supplies of naganol ran short and the drug in fact completely disappeared from the market with the result that the veterinarian felt himself left where he started more than 10 years ago. British pharmaceutics, however, lost no time in producing another proprietory durg antrypol reported to be relatively equivalent in action against animal trypanosomiasis. This drug has since replaced naganol. Extensive use of this drug has been made in India for treatment against Surra, particularly on the Assam Burma border where Surra almost threatened to paralyse movement of animals.

Peat (1945) reports that in 1942, after the Burma campaign, there was a very serious outbreak of Surra in the horses and mules on the Assam Burma border. Many thousand animals contracted the disease and at one time 17 per cent animals of the force were out of action on this account. As a result of measures taken the disease was brought under control and during the worst months the percentage of infected animals fell from 17 per cent in 1942 to 7 per cent in 1943 and 2 per cent in 1944. The control of Surra is dependent on early diagonsis, treatment and removal of infected animals before they can be source of infection to others. At present early diagnosis is possible only by frequent microscopic examination of wet blood films.

It would appear that efforts so far directed have been more towards cure than prevention. It is recognized that early cases are more easy to cure than those in which the disease has existed for some length of time. It must be admitted that what is termed 'early stage' has not yet been clearly defined under experimental conditions. Under natural conditions of course it is not possible to determine the duration of the disease except for the average beginning of the 'fly' season.

In order to detect cases in early stages some work has been done, for serological diagnosis of Surra. Thus in camels Bennett's formol gel test and mercuric chloride test are reported to be sufficiently determinative. No such tests have proved of practical value for field workers for diagnosis of Surra in other animals. The protozoologist at the Imperial Veterinary Research Institute has done considerable work on these lines and have suggested (*a*) Complement fixation test and (*b*) an allergic test.

Kazanskii (1940) carried out some work on the serodiagnosis of Surra in horses in Russia, in five cases of experimental infection. he found that horse blood serum gave a positive complement fixation reaction, after the disappearance of trypanosomes from the peripheral blood.

How far these tests come to be of practical value remains to be seen. Control of Surra seems to be delegated more towards treatment of infected cases than toward

prevention. Efforts towards prophylaxis have however been made, not only outside India but in India also. Sen (1937) carried out controlled experiments and showed that naganol given in doses of 2 grams per 1,000 lbs. B. W. remains in trypanocidal concentration in blood circulation for a period of at least one month and recommends its use as an effective preventive during the Surra season.

Army authorities in India recommended Antrypol as prophylactic drug treatment. The prophylactic dose is 0·5 gramme for 100 lbs. repeated every 21 to 28 days.

Gopalkrishnan (1942) has obtained good results by using Naganol as prophylactic treatment in endemic areas of Assam. He recommends 50 c.c. of a 4 per cent solution of Naganol, for an average pony weighing about 500 lbs., to be given once a month during the season. But these observations have not found much application in the field. This is probably due, either to the high cost of the drug or to the lack of initiative and knowledge.

At the Third Animal Husbandry Wing meeting held at Delhi in 1939 the following recommendation with regard to Control of Surra was made :—

"That in those areas where Surra is prevalent, surveys should be undertaken in collaboration with the Mukteswar Institute, on the likely blood-sucking arthropods with a view to ascertaining the species of the vectors involved in the spread of the disease. In the meantime, measures should be taken, in selected Surra areas, for the destruction of the egg clusters of Tabanids, which are believed to be common vectors of the disease."

During the period that has elapsed since the above mentioned recommendation was made it appears that very little work has been done to destroy the egg clusters of Tabanids perhaps because of the inefficiency of this method of approach to the problem. It must be admitted that insect vectors responsible for transmission and spread of Surra in India have not yet been precisely determined and it seems not unlikely that besides the Tabanus some other vectors may be responsible. It is therefore essential that systematic study of Surra transmitting agents be carried out before steps against these could be taken up. Also the problem to deal with vectors of Surra appears to be so vast that efforts to control these may not be commensurate with expense involved either on curative or preventive remedial measures. There is reason to believe that apart from known insect vectors there may be several other arthropods acting as mechanical transmitting agents present in affected areas. The task therefore of control of Surra by eradication of insects appears to involve vast technical labour, the complete success of which is difficult to foresee.

On the other hand control of Surra can be achieved either by periodical prophylactic administration of one of the known curative agents or by a suitable serological or allergic tests.

At the present time routine method of treating Surra is by administration of one or more intravenous injections of Antrypol.

In each Province different methods of treatment with Antrypol are in practice' there is no uniformity which, shows that more work requires to be done on this important problem. On the whole large measure of success has been achieved in the treatment of Surra with Antrypol yet an usually large percentage of treated cases relapse. There is no record to show whether Antrypol has been given intrathecally. Perhaps this may be due to overestimation of the value of intravenous alone treatment with Naganol.

Sen (1933) while summing up the work on curative treatment of Surra in equines concludes that the intravenous—intrathecal method has registered a definite advance as being, well calculated to prevent the occurrence of relapses, the method represents, in reality, an extension rather than supersedence.

It is very important to prescribe accurate doses of antrypol in order to minimize chances for relapse for the grave danger of the parasites acquiring drug fastness. This is one of the most potential dangers the veterinarian must guard against. In fact steps should be taken to see if the Casual agent has not already acquired this faculty (drug fastness) in certain areas where extensive, use of antrypol has been made for sometime. If that be so, fresh efforts will have to be made to find another drug. Bell (1945) has tried an M. and B. Compound 1553, phenanthridinium, for T. Congolense infection in Cattle with satisfactory results. The efforts of this compound on T. Evansi infection in equines deserves to be studied.

Indian Army Veterinary Corps authorities now recommend, after the experimentation and experience gained during Burma Campaign that to prevent relapse the maximum safe dose of Antrypol must be given.

Calcium is the only drug which appears to reduce the toxicity of Antrypol, the results of experiments, however, are not clear cut and opinions are divided. There is no doubt that calcium lactate (1) does not interfere with the trypanocidal action of Antrypol, and (2) is beneficial, treated animals putting on condition much more rapidly than those that receive no calcium.

The following method of treatment is recommended :—

Day 1. Antrypol 0.6 gram per 100 lbs.
,, 2. Calcium lactate 15 grams intravenously.
,, 8. Antrypol 0.4 gram per 100 lbs.
,, 9. Calcium lactate 15 grams intravenously.
,, 22. Antrypol 0.6 gram per 100 lbs.
,, 23. Calcium lactate 15 grams intravenously.
,, 29. Antrypol 0.4 gram per 100 lb.
,, 30. Calcium lactate 15 grams intravenously.

Surra in Cattle and camels is usually of a chronic nature as compared to equines and these animals have been incriminated as potential sources for transmission and spread. It is thus necessary for a successful campaign against control of Surra to protect cattle and camels in localities where the disease is endemic. The choice lies between extermination of transmitting agents and prophylactic treatment. Both these have been discussed above and it seems that it would not be very impracticable to advocate prophylactic administration of antrypol and early detection of infected cases combined with such measures as may be feasible for eradication of insect vectors.

Recommendations :—

(1) Further work should be carried out on the treatment of Surra, so that it could be adopted on uniform lines throughout India. Possibility of new compounds *viz.*, M. B. 1553 phenanthridinium etc. proving better than Antrypol should not be lost sight off. Method of treatment should be simple and not labrious so that it can easily be adopted in the field.

(2) Prophylactic doses of antrypol and other suitable drugs should be worked out and the interval at which these should be given, to protect the animal from natural infection.

(3) Further work is indicated on the methods of early diagnosis of Surra.

(4) Systematic study of Surra transmitting agents should be carried out before steps to control Surra by the destruction of these vectors could be taken up.

APPENDIX II (4).

(a) By Mr. Mohan Singh, P. V. S.

(I). Superintendent, Civil Veterinary Department Jullundur Division Ferozepur.

Incidence :—Surra is an important protozoan disease of equines and camels. In the Punjab, the incidence of the disease in equines is essentially seasonal and synchronizes with the rainy season, or what may be called the fly-season. It is the end of July or the beginning of August that cases start coming at the Surra-centres, for necessary treatment. The peak is reached in the months of September and October, whence it starts to decline. A few stray cases may even be brought in, as late as, the months of January and February.

In Camels, the disease is also known—' TIBARSA ' which means three years disease, and is extremely insidious in its onset. It is not always easy to diagnose the disease in its initial stage, especially in well fed animals. The chronic cases of this disease in camels, therefore, keep pouring in at the Veterinary Hospitals, throughout the year.

Distribution.—The disease is confined to certain regions which are low-ying marshy and prone to periodic inundations. In the Punjab the districts of Sheikhupura, Gujranwala, Sialkot, Gurdaspur, Lahore, Hoshiarpur, Ferozepur, Gujrat, Shahpur, Rohtak, Karnal, Dera Ghazi Khan and Muzaffargarh are usually affected. Out of these, Sheikhupura, Gujranwala and Karnal, suffer the most.

Reservoirs and Insect Vectors.—In the beginning of each Surra-season, infection is transmitted from the " Reservoirs " of the disease, to healthy stock through the agency of the insect vectors. Cattle, buffaloes, camels suffering from surra and possibly wild animals harbour the parasites of the disease in their blood and act as " Reservoirs ". Cattle and buffaloes may apparently remain in perfect health inspite of infection with surra, a well known fact. The insect-vectors are found in abundance in moist, shady and water-logged areas. The biting flies incriminated for transmission of surra belonging to the genera Tabanus, Haematopota, Stomoxys and some others from the genus Lyperosia.

Control.—Prior to the onset of the present war, ' Naganol ' Veterinary also known as Bayer 205 (a German preparation) was extensively employed by the Civil Veterinary Department, Punjab, both for prophylaxis and cure, against surra, with very good results. The supplies of this drug became very scarce with the onset of the war and later the drug was not available at all. In the absence of this drug, the following line of treatment with Tartar-emetic was provisionally adopted in the year 1939, pending the availability of some other curative agent.

Line of Treatment for Equine Surra.

1st day. 50 c.c. of ½% solution of Tartar-emetic intravenously.
3rd day. 50 c.c. of 1% solution of Tartar-emetic intravenously.
5th day. 75 c.c. of 1% solution of Tartar-emetic intravenously.

Followed by 15 injections of 100 c.c. of 1% solution of Tartar-emetic, intravenously on alternative days.

The above-treatment gave very un-satisfactory results. The Trypanosomes reappeared in the blood of the treated animals after about 10 days of the last injection. Complete cures were very rare if any and the drug gave only temporary relief.

Line of Treatment for Camel Surra.

1st day. 50 c.c. of 1% solution of Tartar-emetic intravenously.
3rd day. 100 c.c. of 1% solution of Tartar-emetic intravenously.
5th day. 150 c.c. of 1% solution of Tartar-emetic intravenously.
7th day. 150 c.c. of 1% solution of Tartar-emetic intravenously.

Followed by 12 injections of 175 c.c. of 1% solution on alternate days.
33rd day. 200 c.c. of 1% solution of Tartar-emetic intravenously.
35th day. 200 c.c. of 1% solution of Tartar-emetic intravenously.

The important precaution, that Tartar-emetic solution should not be injected when the Trypanosomes are present in the peripheral circulation was impressed upon the staff dealing with surra cases. They were asked to administer the drug intravenously during the interval between the paroxysms.

The above mentioned treatment gave variable results in camels. Those animal which were detected in the early stages of the disease and were in good bodily condition, responded satisfactorily to this treatment. While others in advanced stage failed to show any signs of recovery.

The question of control of surra, as such remained a vexed problem upto the year 1941, when limited quantities of 'Antrypol' manufactured by the Imperial Chemical Industries Ltd., London, were made available for experimental trials. A batch of 8 animals consisting of 6 horses, one filly and one camel which were declared positive to Trypanosomiasis by microscopical examination of blood were subjected to treatment with this drug (Antrypol). Six out of these 8 animals were in poor bodily condition.

The method of treatment employed was as under :—

1. First injection of 5 gms in 50 c.c. distilled water, injected intravenously.
2. 2nd injection of 2·5 gms. in 50 c.c. of distilled water, injected after a week.
3. 3rd injection of 2·5 gms. in 50 c.c. injected after 2 weeks of the 2nd injection.

Out of 8 animals treated with this drug, one being in advanced stage of the disease died on the 12th day of the injection and an other relapsed after about 2½ months of the treatment and also died. The remaining six cases were completely cured. The cure percent with this drug according to the above reported data comes to 75 percent.

On the results of this experimental trial, the use of Antrypol as a curative against surra was approved by the Director, Veterinary Services, Punjab, in the year 1942. So far this drug has been made available only in small quantities to the Various surra centres. The results obtained are encouraging. Animals treated in the early stages of the disease responded fairly well, to this treatment, while others handled late, showed liver complications and often relapsed. Further trials under controlled conditions are however necessary to assess the efficacy of this drug on the treatment of equine and camel surra.

Regarding the best means of making practical use of the latest information concerning the control of surra, the following points come up for consideration.

1. *Eradication of Insect Vectors* :—Though possible, this problem appears to be impracticable in a vast country like India, with several forests, low-lying and water logged areas, several rivers, canals and their banks and many other marshy places, which are favourable to fly breeding.

2. *Prevention of Bites from Infective Flies.*—This also seems to be very difficult question under field conditions as most of the animals have to work out-doors in the fly season. They are also to be grazed in the open fields for the reasons that the village farmers can ill-afford to stall feed all their stock. Several fly repellents which have been tried, have a temporary effect for few hours. There are no effective fly nets which could be used to prevent fly bites. Even if there be any their cost and labour involved in keeping them in position on the animals while at work and at grazing will act a prohibiting factor.

3. *Exclusion of ' Reservoirs '.*—This is not possible, as the destruction of cattle and buffaloes which act as reservoirs for the disease parasites, is obviously impracticable.

4. *Control of the Disease Through Curative Agents.*—This is possible if an effective drug like ' Naganol ' is evolved through research work. It can be used as a prophylactic measure in small doses, during the surra season in healthy animals as well as, for the treatment of affected cases. The efficacy of ' Antrypol ' which is now available in the market should be tested for both these purposes, under controlled conditions.

5. *Establishment of a Central Organisation to Disseminate Latest Information Regarding the Control of Surra to Provinces.*—The establishment of such an organisation in the Centre is very necessary in the interest of the control of the disease. This body should undertake to collect the latest information regarding the advances in the line of treatment and control of this surra from various institutions and workers and to disseminate the same to the provinces. If there is no objection this task can be entrusted to the Animal Health Committee of the Animal Husbandry Wing. Provinces should give a trial to the recommendation of this body and report the results. In this way the work done in the various provinces could easily be corraborated.

APPENDIX II (4)

(*f*) By Syed Mahmud Ali, Bengal.

How, Surra was introduced into Bengal and when, is not known. The observations of the author are based upon his personal knowledge and experience of this pest during the past eight years. During this period Surra was found to be prevalent from north to south and east to west in an endemic form and sporadic cases amongst horses, cattle, buffaloes and dogs were reported irregularly from all over. Such reports were more frequent on account of movements of military transport animals in the eastern zone. It was known mules and ponies of Indian Army Veterinary Corps had frequent outbreaks of Trypanosomiasis and a number of them were either destroyed or fell to its prey.

Physical features of the province and the climatic conditions are apparently ideal, for growth and multiplication of at least some of the hosts, carriers and insect vectors. Fly belts constituted by Tabanus and Stomoxys extend in all directions and the insect vectors are most abundant during the rains specially. The chars in the delta of the Ganges and the Brahmaputra which cover almost the entire land and the Terais of the Himalayas in the north are covered with forests with large number of wild animals serving as reservoir, perhaps as host for the parasite. *Trypanosoma evansi* and possibly others, pathogenic or non-pathogenic. Besides the climate is humid and the rain-fall high, often inundating vast tracts some times for months together. The marshy lands encourage luxurious growth and multiplication of the insect vectors. Evidently the problems relating to the incidence of this pest in the eastern zone are much too complicated and at least at the moment it seems difficult to forecast what programmes should be productive of results, the best possible results and if our dreams of complete eradication of Surra will be actualised. The cycle of events, as at present it appears to be, consists of the wild animal carrying the parasite, the fly sucking the blood of this wild animal, the domestic animal going to the *char* or to the *terias* for grazing owing to a general scarcity of fodder and high cost thereof, receiving infection from the flies and spreading this infection amongst others, either of the same species or a variety of the common stock. These events re-

cur systematically all the year round and their intensity is augmented abnormally during the rains, inundation and flood, the conditions and environments most favourable for the biting flies, Tabanas and Stomoxys.

Careful enquiry has failed to reveal the presence of any known sick stags or deer in the forests close to the seat of Surra outbreaks; but, nevertheless, in view of mild nature which the disease may assume in otherwise healthy wild animals and the difficulties in observing them, it is not impossible that such cases are there. It is known that cases of the disease have been reported from cattle in spots adjacent to thick forests.

There is certainly a second source, well established, which must not be overlooked. The incessant move of livestock from west to east, so essential for readjustments of requirements of a deficit tract. Cultivation season in Bengal starts about February. The peasant is anxious to prepare his fields and keep them in readiness for the cultivation season ahead. He is either short of working bullocks or his stock is completely deteriorated and more or less unfit for hard work at the plough. As a matter of fact there are some forty lakhs acre of cultivable fallow land spread over in all parts and this unhappy state of affairs is partly or wholly due to paucity of livestock. Thus the Province is compelled to procure a large number of cattle and buffaloes from the west. The extent of cultivation referred to elsewhere is in direct proportion to the intensity of seasonal requirements for livestock and such seasonal requirements tally with the periodical rush of dealers in livestock and the simultaneous movements of the animals from the west. There is a rush generally of cattle and buffaloes before the rainy season. Some of these animals are reservoirs of Trypanosomes leading to outbreak of these pests amongst the starved and run-down livestock in this zone. Such cases are commonly evidenced in Districts like Murshidabad, Midnapore, etc. which are close or adjacent to Bihar and Orissa. It may be interesting to analyse very cursorily, how and why cattle and buffaloes are particularly susceptible to disease about this time. General shortage of food, draught, hard work at the plough incessantly and for days together. Needs of the cultivator—excessive and far beyond the capacity of an animal at work.

Thus sources of infection of Trypanosomiasis, at least in this part of the country, so far known are—

(*a*) indigenous appearing spasmodically at regular intervals, and

(*b*) recrudescence due to seasonal movements of livestock from the west.

Surra zones.

Trypanosomiasis was first detected amongst hackney carriage ponies in the district of Dacca. The climatic conditions and environments in this district were ideal for its incidence and the first report of mortality amongst the equines, cattle and dogs were received about the beginning of 1939 when the writer himself visited the affected localities. The investigation into the incidence of the pest was started immediately and it was discovered that it had been going on in the locality for several months, in fact animal owners knew of it for years and could recognise a case at a glance. The infection was widespread and it fairly closely followed the forest belts where wild animals and the flies of Tabanas and Stomoxys group were abundant. Nearly a hundred cases were confirmed microscopically on the spot and the loss due to this outbreak was considered to be at least a few thousand head of equines and cattle and some dogs which apparently contracted the disease by feeding on infected carcases. This story was repeated in the central zones, the north, south, east and west. Simultaneously the disease was notified from Murshidabad, Birbhum, Bankura and Midnapore districts along the western frontier of the province. In such

cases there was invariably history of infection amongst cattle and buffaloes starting at a centre from cattle and buffaloes purchased either from Bihar or Orissa. An interesting outbreak of this nature occurred last about the middle of 1944 in Jhargram sub-division of Midnapore district. A few buffaloes were brought to certain villages about the beginning of July from Bihar and the infection flared up there amongst cattle, buffaloes and dogs immediately. It stopped automatically after a week or two but the mortality was there again a few days later. Smears were confirmed for Trypanosomiasis only after a large number of animals was victimised.

Treatment.

Literature on the treatment of Trypanosomiasis is voluminous and beside a cursory reference, it will be superfluous to dwell upon this subject at length. A large number of Trypanocidal agents were tried by eminent scientists like Lingard (1899), Holmes (1908), Leese (1910), Cross (1914) and Edwards (1928). In India Sen, Mahajan and Shahi made certain improvements when applying various methods under field conditions. The results reported by them are remarkable and their utility cannot but be appreciated by district staff under field conditions. However the work in progress upon the Chemotherapy of Trypanosomiasis due to *T. Evansi* warrant the following steps for treatment and cure.

A.—Bovines.

Outbreaks of Surra in cattle, including buffaloes, which are often reported from various districts (with high mortality, particularly among buffaloes) are easily checked by intravenous injections of relatively simple trypanocidal agents, such as Tartar Emetic or Bismuth Phosphate. Single injections usually suffice. A suitable therapeutic dose of Tartar Emetic is 5 c.c. of an M/10 (3·2 per cent. solution) per 100 lbs. body weight. The treatment does not destroy all the parasites in the animal system. Some persist thereafter in a latent state of activity, apparently indefinitely.

In therapeutic treatment the drug displays intensive trypanocidal properties, and the dosage mentioned above, although it can be tolerated by a healthy animal, when administered into a cow or a buffalo showing Surra parasites in its peripheral circulation brings about disastrous results occasionally, the patient dying even before the termination of the injection. Examination of the peripheral blood shows that the trypanosomes have vanished, and it is therefore presumed that death has been occasioned by the occlusion of the blood capillaries with dead trypanosomes, or possibly, by the liberation of their toxic products. For such emergencies it is best to keep normal saline at hand and give a profuse intravenous injection to the animal manifesting symptoms of shock. This may give relief if the administration is resorted to in the nick of time.

Administration of 25 to 30 c.c. of a 3·2 per cent. solution of Tartar Emetic intravenously to local cattle and 30 to 35 c.c. to buffaloes followed by (about the time when the patient is expected to get a relapse) a therapeutic dose (intravenous) of Naganol (25-30 c.c. of a 2 per cent. solution) has proved more efficacious, and may be resorted to in preference of any other system when Naganol is readily available.

B.—Equines.

(*a*) *Bayer 205* (*Naganol*).—The results obtained by the application of Bayer 20 surpass those obtainable by other medicaments.

(*b*) A suitable therapeutic dose for intravenous administration is 5 grms. in 10 per cent. aqueous solution, per 1,000 lbs. body weight.

The therapeutic effect of Naganol in cases of Surra is clearly shown 24 hours after injection by fall in temperature, improvement in appetite, and other signs of health. One injection is as a rule enough for a cure, if an adequate dose in injected.

In a circular previously issued by the Imperial Veterinary Research Institute, Mukteswar, for treatment of Surra in horses, a combined intravenous-intrathecal method of administering the drug was recommended. This recommendation was based upon certain experimental observations which seemed to point to the conclusion that the drug, when introduced into the peripheral circulation alone, was not capable of approaching the cerebrospinal fluid where the parasites generally multiplied and attacked the elements of blood periodically. The results of more recent trials have proved that unless the animal is already in an advanced stage of the disease, with nervous systems involved (in which even drug intervention is hardly likely to be of any avail), intravenous medication alone is sufficient for a cure. The injection should be given into the jugular vein.

(*c*) The drug remains in the general circulation for a long time, apparently about two months, in sufficient concentration to exert a manifest trypanocidal action. Hence, in species of such high susceptibility as the horse which exhibits progressively increasing vulnerability with each parasitic relapse—in contradiction to what transpires with the bovine species, which is usually able to defend itself after assistance from a chemotherapeutic agent in the course of virulent invasion—the lack of liability to the rapid excretion characteristic of other medicaments employed is a property of great importance and fortifies the patient in withstanding relapses, from tissues back washes, until the risk of such relapses disappears.

(*d*) The therapeutic dose of Bayer 205 noted above may be safely introduced into the circulatory blood when large number of trypanosomes are present in it complete disappearance takes place after an interval amounting to several hours, and thus the alarming symptoms set up by drugs like Tartar Emetic which cause rapid destruction of the parasites (leading to the saturation of blood with their endotoxins and interference with circulation specially of the central nervous system by a process of embolism consequent upon the circulation of broken down trypanosome clusters) are not seen.

(*e*) Naganol, when available, might be used with much advantage as a prophylactic agent for the protection of horses exposed to Surra in badly infected zones. Intravenous dosage, at the rate of 1 grm. per 1,000 lbs. body weight, repeated at intervals of three to four weeks, would appear to suffice. But for therapeutic treatment early intervention with the largest dosages capable of being supported by the infected animal is the method of treatment ultimately to secure complete sterilisation, which again is an essential condition for the establishment of a clinical cure in such highly susceptible species as the equine species.

(*f*) *Tartar Emetic.*—This compound comes next in value to, though far behind, Bayer 205. It may be tried when Naganol is not procurable, but effects are generally very fluctuating. Relapses may subsequently arise. Again, in animals in low condition or possessing an idiosyncrasy towards the effects of the drug, death would appear to result from the drastic nature of the treatment. (On account of its liability to relatively rapid excretion therapeutic doses of Tartar Emetic must be repeated at frequent intervals—every day or every alternate day, until about ten or more such injections have been given.)

The non-availability of Naganol in the recent years prompted a new era in the chemotherapy of Surra. In Bengal drugs like Antrypol, Acetylarsan, Urea Stibamine (Brahmachari), Anthio-Maline and other arsenic and antimony preparation

were given extensive trials both for the treatment of the equines and bovines and the prevention of the disease. Almost all the preparations showed a greater or a smaller trypanosomidal effects but with the exception of one or two none gave what may be termed a complete recovery. Antrypol was next to Naganol for Surra in equines and bovines whilst results with Acetylarsan, though encouraging, cannot be stated to be so good. Others bearing a temporary relief failed to give satisfactory results. It was also possible to make a comparative study of the therapeutic value Naganol, Antrypol, Tartar Emetic and Acetylarsan. A large number of horses in badly infected areas were split up into four batches and subjected to treatment according to approved methods, Naganol and Antrypol were the best whilst Tartar Emetic injections proved fatal in majority of cases. The Antrypol animals showed severe reaction within 24 hours of injection which generally appeared in the form of acute swelling in the head region. Of course a large number of animals were free from such reactions. Observations on the animals recovered were continued for a period of one year by specially trained staff employed for the work whole time. Blood smears from such ponies were examined periodically and systematically. One fact was conspicuous, whether it was due to any fault in the techniques, employed it is difficult to say. A number of them though apparently in the best of health showed the parasites in the blood films, though their number was very small. Similar phenomena were evidenced in the buffaloes.

Control and Prevention.

It is stated elsewhere Surra in this province is widespread and a brisker programme of work had to be chalked out in the past for its control and prevention. It was first of all considered necessary to engage special staff exclusively for this work. The officers were designated as Glanders Inspectors and they moved about extensively in the affected zones for systematic examination of susceptible species, for treatment of cases confirmed, control of outbreaks prevention of disease and finally for enforcement of provisions under Glanders and Farcy Act when and where necessary. Measures adopted for control—and prevention were generally as under :—

1. Isolation of cases at least half a mile away from the spot of infection and from sound animals. Suspicious animals were treated accordingly until diagnosis was confirmed.

2. Record of temperatures daily up to 14 days (period of incubation) of all animals from an affected stable and examination of blood smear under the microscope.

3. Inspection of the ground in the vicinity of stables. Any low-lying land of pools within a radius of half a mile which were likely to be breeding grounds for biting flies received attention.

4. Animals were clothed as part protection from biting insects, particularly at evening time from 4.o'clock onwards, and in the morning up to 8-30. Biting flies usually rest in the middle of the day when it is very hot. Horses were stabled as much as possible as flies avoid entering the stables and molest therein.

5. A number of fly dressings were tried. Some well-known preparations are etailed as under :—

(*a*) Application of Creolin.
(*b*) Petroleum and its compounds.
(*c*) Oil Citronella.
(*d*) Cheer Ping Oil.

6. Grooming and cleanliness of the body were not neglected. A dirty body is always more attractive to flies of all kinds than a clean one.

7. Steps under " Glanders and Farcy Act " (Act XIII of 1899) are abridged as under :—

(*a*) Effective segregation of the affected and in-contacts.

(*b*) Communication between infected and healthy spots was restricted.

(*c*) Cremation, as far as possible, of all diseased carcasses unskinned and in addition disposal by burning of all stable refuge. Otherwise carcasses were buried with freshly burned lime at a depth of at least six feet.

(*d*) Disinfection by full exposure to the rays of the sun of all stables and places where infected animals were kept. Whenever possible, all standings, woodwork etc., were thoroughly disinfected by a blow lamp.

(*e*) Skins of animals were on no account removed.

Discussions.

Evidently, in the light of what has been stated in the previous paragraphs nothing is being left undone taking into consideration all developments, up-to-date to eradicate or at least to control the pest in this part of the country. There is the so-called Veterinary Police, systematic survey, best type of chemotherapy, immediate diagnosis and prompt measures for control and prevention ; but in spite of everything results are not what they should be. Surra is in Dacca, it is in Chittagong, it is in many other parts of the province continuing to be a menace to our livestock. There seems to be little prospect of visualise our dreams of eradication of this pest from the country in the near future, if we go on working on the existing lines without giving a more careful consideration to the various aspects of this problem. Facts which emanate from known data are :—

(1) Extensive infection.

(1*a*) Increase in infection.

(2) Abundace of intermediate hosts.

(3) Carriers, wild animals, apparently healthy animals, animals recovered after treatment etc.

(4) Possibility of a multiplicity of strains of the trypanosomes ; and

(5) Multiplicity of the host.

Any way it seems essential to intesify firstly the research on trypanosomiasis of animals and secondly its application under field conditions. There should not only be an independent section at the central research institute but in addition to this the provinces specially those where the disease is widespread should establish regional research stations and employ specially trained staff for the control of outbreaks, prevention and eradication. Such effort may be made more effective by reception of legislation and tackling the pest in all species on the same lines as is the case for Galanders. Unless this is done it is expected we cannot go very far.

Recommendations.

It is high time trypanosomiasis amongst animals must engage attention of highly trained and specialised Veterinarians in the country and that steps should be taken to apply the results on an extensive line. Efforts for control, prevention and eradication of the pest should be supplemented by legislative powers on an all-India basis.

APPENDIX II (5)

MONTHLY STATISTICAL BULLETINS REGARDING " OCCURRENCE OF CONTAGIOUS DISEASES TO BE PUBLISHED BY U. N. R. R. A. SOUTH WEST PACIFIC AREA INTERNATIONAL VETERINARY AND LIVE-STOCK SECRETARIAT—FURNISHING INFORMATION FOR—

By I. C. A. R.

The U. N. R. R. A. South-west Pacific Area, International Veterinary and Live-stock Secretariat desires to publish for distribution to its member countries monthly statistical bulletin incorporating information about the occurrence of contagious diseases in different countries with a view to preventing the spread of animal diseases which are likely to occur in the member countries. India, being one of the members of the U. N. R. R. A, is expected to furnish such information to the Secretariat for publication. The Indian Council of Agricultural Research has undertaken to act as the agent of the Secretariat in this country.

It is suggested that in order to collect the necessary statistics the attached proforma No. 1 may be adopted by all the provinces and states with such modifications as would be necessary in view of the proposed list of diseases of which information is required. It is desirable that this information should reach the Indian Council of Agricultural Research, New Delhi, by the first week of each month, so that it may be consolidated in proforma No. 2 (attached) and transmitted to U. N. R. R. A., secretariat in time to be published in the said bulletin.

In most provinces it is believed that the information concerning contagious disease is passed through the following channel—Village Patwari, Veterinary Assistant Surgeon, Deputy Superintendent, Superintendent, Director of Veterinary Services. The Director of Veterinary Services would transmit the information to Indian Council of Agricultural Research, for forwarding it to U. N. R. R. A. The time taken on the average may thus be—

	Days.
Patwari to Veterinary Assistant Surgeon	3
Veterinary Assistant Surgeon to Deputy Superintendent (including diagonsis and investigation)	7
Deputy Sueprintendent to Superintendent (weekly reports)	7
Superintendent to Director of Veterinary Services (monthly reports)	15
Director of Veterinary Services to the Indian Council of Agricultural Research	7.
Indian Council of Agricultural Research to Australia (*i.e.* U. N. R. R. A., S. W. P. Sect.	10
Total Number of days	49

This period may be shortened by 22 days by the Indian Council of Agricultural Research receiving copies of weekly reports direct from the Deputy Superintendents, but such a process would entail the maintenance of special clerical staff at the Indian Council of Agricultural Research which the saving in time does not seem to

justify. A matter of 6 weeks is of no great consequence to a report of the kind envisaged, but in practice it may be quite possible that the delay in receiving reports may entail much longer period than that indicated above. What is required is a method which will facilitate the regular submission of reports at the arranged time rather than one which aims at getting the information rapidly.

The diseases regarding which information may be required by the member countries are included in the schedule list (attached). India will supply information regarding the following diseases on the list :—

(1) Rinderpest,
(2) Foot and Mouth diseases,
(3) Bovine Contagious Pleuro-pneumonia,
(4) Glanders,
(5) Anthrax,
(6) Johne's disease,
(7) Black quarter.

Further, it was felt by a U. N. R. R. A. Conference that the above method of reporting in the case of certain diseases appearing in countries, assumed to be previously free of them, is not rapid enough to safeguard the nations which might be importing livestock of animal products from the reporting country. It is desired, therefore, that notice of the occurrence for the first time in a reporting country of a scheduled disease, (list of scheduled diseases attached) or of a recrudescence of a scheduled disease in a country which had been declared clear of it or of extension of those diseases into areas previously unaffected should be transmitted by cable or telegram to U. N. R. R. A. International Veterinary and Livestock Secretariat.

It is suggested that the best means of transmitting this information without loss of time would be for the reporting veterinary authority to telegraph the suspected presence of the disease to the Director of Veterinary Services, with a copy to the Indian Council of Agricultural Research. The Director of Veterinary Sarivces would doubtless than instruct an appropriate officer to confirm the presence of the disease. The investigating officer in return would report by wire to his Director with a copy to the Indian Council of Agricultural Research. The Indian Council of Agricultural Research will then transmit to U. N. R. R. A. this information by cable.

The following form might be adopted for report :—

Statement showing Occurrence of Contagious Diseases for the First Time in the Province or State of—

Province/State.	District.	Name of disease	No. of cases at the time of reporting
1	2	3	4

and using the code word VUNNRA, the following is the sample of a telegram which would be despatched :—

VUNNRA A.A.A One Bengal A.A.A two Dacca A.A.A three swine fever A.A.A four four hundred and sixty-three

From :. (Code word for Director of Veterinary Services).

List of Scheduled Diseases.

) Cattle Plague,
) Foot and Mouth disease,
) Swine fever,
) Sheep pox,
) Goat pox,
) Contagious Bovine pleuro-pneumonia,
) Fowl Plague,
) Rabies,
) Glanders,
) Sheep scab,
) Anthrax,
) Cattle tick fever,
) Infectious equine eucephalomyelitis,
) Infectious equine anaemia,
) Johne's disease,
) Psittacosis,
) Trichinosis,
) Surra,
) Dourine,
) Tulraemia,
) East coast fever (T. Parva).

PROFORMA No. 1.

CIVIL VETERINARY DEPARTMENT.

nt showing the districts from which scheduled disease or diseases were reported during the month of 19 .

ricts	Rinderpest		Foot and Mouth		Haemorrhagic septicaemia		Black quarter		Anthrax		Other contagious diseases	
	No. of villages affected	No. of outbreaks reported / No. of cases reported	No. of villages affected	No. of outbreaks reported / No. of cases reported	No. of villages affected	No. of outbreaks reported / No. of cases reported	No. of villages affected	No. of outbreaks reported / No. of cases reported	No. of villages affected	No. of outbreaks reported / No. of cases reported	No. of villages affected	No. of outbreaks reported / No. of cases reported
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PROFORMA No. II.

INDIA

DEPARTMENT OF AGRICULTURE—DIVISION OF INDIAN COUNCIL OF AGRICULTURAL RESEARCH.

Return of Quarantinable Diseases of Stock in the Various Provinces and States of India for the Month of . 194 .

A = Reported during month. B = Total number under control at end of month.

Disease	Baluchistan		United Provinces		Punjab		Bihar		Orissa	
	A	B	A	B	A	B	A	B	A	B
ANTHRAX (Fievre Charbonneuse)										
Number of districts										
Number of villages										
Number of diseased animals (Died or destroyed)										
BLACKLEG (Charbon Bacterien)										
Number of districts										
Number of villages										
No. of diseased animals (Died or destroyed)										
JOHNE'S DISEASE (Entritis Paratuberculosa Bovis)										
Number of districts										
Number of villages										
Number of diseased animals (Died or destroyed)										
PLEURO-PNEUMONIA CONTAGIOSA Bovum (Peripneumonie Contagieuse)										
No. of districts										
No. of villages										
No. of diseased animals (Died or destroyed)										

NOTE.—Swine fever, Fowl Plague, Infectious equine anaemia, Psittacosis, Tularaemia, East coast fever do not exist in India.

APPENDIX III (1)

(a) A NOTE ON THE ECONOMICS OF VILLAGE MILK PRODUCTION WITH RECOMMENDATIONS FOR IMPROVEMENTS IN THE MARKETING OF DAIRY PRODUCE SO AS TO ENSURE A SATISFACTORY PRICE TO THE PRODUCER, BY THE CENTRAL AGRICULTURAL MARKETING DEPARTMENT.

(In the present note only the cow and the female buffalo is taken into account leaving out the other milch animals, such as sheep, goats, asses and camels, whose hand-drawn milk yield is unimportant from the commercial point of view except in certain parts of India, like Rajputana, where, for example goat milk is used for making ghee).

I. Production of Milk in Rural India.

Numerically India possesses the largest cattle population of any country in the world. According to the 1940 census, the three year old milch cattle population is

Cows	490 lakhs approximately 47·044 millions.
Female buffaloes	214 lakhs approximately 21 millions.

Of this number, 470·44 lakhs cows and 201·61 lakhs of female buffaloes are to be found in rural India and the rest—19·46 lakhs and 12·75 lakhs respectively in urban areas.

The figures given in the Milk Marketing Report show that 58 per cent of our cows give a milk yield of only 1 to 2 lbs. daily. Nearly a fourth of the cows give less than ½ lb. daily and only 6·8 per cent give the highest yield of 3 to 4 lbs. per day. The number of cows giving more than 4 lbs. of milk per day is negligible.

The she-buffalo performs better than the cow both in milk yield and its butter fat content. In spite of their numerical inferiority buffaloes provide 50·9 per cent of the total milk production.

Only a negligible number of calves are weaned and reared hand fed. The usual practice in India is that all calves have their feed direct from their dam's udders. This leads to the difficulty of judging correctly the quantity of milk consumed by the calf at each milking or during the whole lactation. The Indian Council of Agricultural Research Village Inquiry Report reveals, however, that on the average 274 lbs. of milk is consumed by the calf of a cow and 369 lbs. by the calf of a she-buffalo. Approximately 1095 lakh maunds of milk are consumed by the calves directly from their dams. Thus the annual total production of hand drawn milk is estimated at 6099 lakh maunds and is valued at roughly Rs. 183 crores. It would therefore, be observed that the practice of allowing the calves to consume milk *ad-lib* from their dams is a huge economic loss at the very outset. Data relating to the annual production of milk in the previous years are not available. One point is, however, clear that production has not kept pace with the increase in human population. Census results show that during the 20 years ending 1941 the population increased by 27 per cent compared with only 5 per cent increase in the number of cattle. *It is also believed that under the prevailing conditions the milk-*

quality of Indian cattle has deteriorated during recent years. The fact the Indian cattle give milk which is richer in butter fat content, though less in unt when compared with their opposite numbers in foreign countries, is no con- tion, since the present day production does not meet the need of the people and ny rate 58 per cent of the total is converted into ghee which entails considerable nomic loss to the producer.

To work out the annual gross production of milk the average figure of 486·7 lbs. cow and for female buffalo 1229·2 lbs. of milk, as given in the Report on the Mark- g of Milk, has been used, and the results are tabulated below.

Production of Milk in India.

	Number of cattle (In lakhs).		Average annual yield per animal (Hand-drawn). Lactation period.		Net total production. (In lakh lbs.).		Net total production. (In lakh maunds).	
	Cows.	Buffaloes.	Cows (210 days).	Buffaloes (300 days).	Cows.	Buffaloes.	Cows.	Buffaloes.
ral .	470·44	201·61	486·7 lbs.	1229·2 lbs.	228,963·1	247,819	2782·7	3011·9
ban .	19·40	12.75			9471·2	15072·3	115·1	190 5
dia .	489 90	214·36			238,434·3	263,491·3	2897·8	3202·4

This works out at 2 lbs. 5 ozs. per day if the milk-yield is taken on the basis of erage lactation of about 210 days for the cow, the average yield of a buffalo being times that of the cow.

When considering the above facts it is important to bear in mind that many anges have taken place since the date, as given in the Report on the Marketing of ilk, was collected for working out these production figures, for example the famine nd the heavy demands of the home and allied armies during the late war may have epleted out livestock population. The figures, therefore, may not be accurate to ate. They do, however, serve as a basis for discussion.

I. Conditions under which milk is produced in villages and the difficulties of the Indian farmer.

A fact, which is often overlooked when comparing European with Indian milk roduction, is that in India dairying, as such, is not a national industry. The num- er of large herds is surprisingly low even on Government and private dairy farms. Milch cattle are mainly owned by petty rural producers generally in lots of 2 or 3 nd milk production is, more or less, a sideline of agriculture. The cattle are seldom ufficiently well fed to give a satisfactory milk yield. The average farmer maintains his small number to meet his own needs (according to the survey under-taken by partment, it is estimated that roughly 9 percent of milk is retained by the

producer) and what quantity of milk is left over is converted into ghee, which is collected over a period and ultimately sold to either a middleman (village *bania*) or retailed to individuals at village gatherings. This, of course, is partly due to the fact that cultivators situated in areas remote from towns cannot market their milk in the raw state, though this market is in any event very limited owing to the scattered nature of the villages involving long distances. It is also partly due to the fact that ghee production meets the special needs of the cultivator, since it provides him with a cash sale, in addition to leaving him *lassi*. This policy of the farmer cannot be expected to yield him an economic return. Values at say 9 annas per lb. (retail price pre-war), ghee gives a cash return of Rs. 3-6-0 per 100 lbs. of milk. While the same quantity of milk sold liquid at 1 anna per lb. would give Rs. 6-4-0 or roughly twice the sum realised for ghee, yet far more milk is utilised for ghee manufacture than is sold for liquid consumption.

The technique of milk production is very similar throughout India. The udder may or may not be washed or cleaned with a clean cloth. Immediately after milking the calf is allowed to suckle and the cow is then hand milked, wet milking being usually employed. The hand of the milker may or may not be washed. The milking vessel is scoured with mud and ashes, rinsed with water and occassionally smoked over a fire. The milk is subsequently transported to the nearest market by head load, bicycle or cart and in some parts by buses. Starvation of stock, squalor, filth, ignorance or indifference towards hygienic principles, revolting personal habits, such as clearing of throat while in the actual process of milking the cow (droplet-polution of milk) allied to official apathy combine to produce a panorama of backwardness in the affairs of dairy farming in this country.

Adulteration is another feature. It constitutes one of the most urgent and difficult problems of milk distribution. One of the prevailing causes of adulteration is the necessity of keeping the price of milk within the purchasing power of the consumer. It is obvious that unless milk distribution can be put on a sound basis adulteration is inevitable.

As in the problems of milk production so in the problems of distribution much work of an elementary nature needs official attention.

The middleman (*bania*) is a great menace to the farming community. The perpetual debt, under which the Indian farmers work, is one of the main causes of his apathy and indifference towards the problems of dairy farming which otherwise would give him better returns.

III. Consumption of fluid milk and dairy products

Although over 95 per cent of the milch cattle are found in rural areas and over 90 per cent. of the Indian population live there, the rural demand for milk is relatively poor in the sense that there are not many purchasers of milk in the villages. The reasons are that many of the consumers themselves are the producers, while due to comparatively low purchasing power of the Indian peasantry many cannot afford to purchase or consume milk or milk products. Many persons, including children have to go completely without milk. Even in the dairying tracts, where much larger quantities of milk are produced, 16 per cent of the families do not consume any

milk or milk products at all. Condition in those rural parts of India, where the production is much, less should therefore be still worse in regard to the purchase or consumption of milk and milk products.

The average daily per capita consumption of milk in India, including products is estimated at 5·8 ozs. It varies considerably from tract to tract according to the production of milk and the density of the population. Sind tops the list with 18 ozs per head per day followed by the Punjab with 15·2 ozs. Assam has the lowest average consumption, *viz.*, 1·3 ozs. per head. It has been observed that the peninsular area notably Madras Province, in spite of its low production compared with population, exports large quantities of ghee to other areas. It partly accounts for the low per capita consumption in that province, *e.g.*, 3·3 ozs. per day. Then again the consumption of fluid milk varies according to the seasons. It decreases during the summer and the monsoon and increases during winter months.

Due to better earning power and purchasing capacity of the urban people, the daily per capita consumption of fluid milk and products, in terms of milk, in cities and towns is found to be 12·6 ozs. or more than double that of the average for India. In the same town it may vary with the family income. Poor people consume less than the rich and some may not get any milk at all. Although in certain tracts of rural India (*e.g.*, Western Punjab) the average daily per capita consumption has been found to be 5 ozs. in addition to 0·6 oz. of ghee, the total milk equivalent is raised to just over 14 ozs. per head per day if the consumption of *lassi* (butter milk) is taken into account.

On the average about 28 per cent of the milk produced is consumed in the fluid form 57 per cent is made into ghee and 5 per cent each into *khoa* and curd. Butter and cream account for only 2 per cent and other products like *rabri*, *malai*, etc., 2·8 per cent. At present only 1/3 per cent of the production is used for making icecream but its consumption is rapidly increasing. Cow milk is preferred for drinking purposes and the buffalo milk for the manufacture of products. 48 lakh maunds of skimmed milk is produced in the manufacture of cream and creamery butter which is mainly used for adulterating whole milk or for the making of cheap *khoa* or curd. Approximately 3·1 lakh maunds of skimmed milk are used for making casein for export.

IV. Cost of production per pound of fluid milk under rural condition.

So far as is known, there is only one set of figures on the cost of milk production worked out some eleven years ago by the Animal Husbandry Bureau of the Indian Council of Agricultural Research. This relates to select animals under Government farm condition mostly in the Punjab and are not representative of the village cattle or the condition under which milk is produced even in that province, much less in India as a whole.

The figures are reproduced in the table below. The feed cost is based on prices prevailing in 1932. They do not include the cost of supervision which is rather heavy on Government farms. They also do not include interest charges on capital To that extent, therefore, these figures are incomplete.

Cost of Milk Production at some of the Government farms.

Items.	Sindhi cows.	Ordinary Sahiwal cows.	Ferozepore Sahiwal cows.	Half-bred cows*.	Murrah buffaloes
	Pies.	Pies.	Pies.	Pies.	Pies.
Cost per pound of milk.					
Food cost during lactation ..	4·48	4·45	3·88	3·55	5·68
Food cost during dry period ..	1·42	1·01	1·01	0·693	1·959
Depreciation on stock	2·01	1·83	1·33	1·42	2·203
Labour cost (exclusive of supervision)	1·51	1·20	0·94	0·83	1·295
Total ..	9·42	9·18	7·16	6·493	11·137
Total cost in rupees per maund ..	4-0-7	3-14-11	3-1-1	2-12-6	4-12-4
Number of animals studied	84	179	51	213	294
Average lactation yield (lb.)	3,050	3,800	6,000	6,000	3,100

*First crosses between imported bulls (Ayrashire, Friesian or Shorthorn) and Indian cows.

It is obvious that the farm records are not applicable to village cattle. They show, however, that the better the milking capacity of the cows, the cheaper is the cost of production of milk or butter fat. The cost of production of a lb. of milk by she-buffalo is more than that from the cow. But for the butter fat it can only be obtained by a specially bred and highly select Sahiwal cow.

Comparative figures of the cost of Government farms and the price at which rural producers sell milk are given in the table below.

Cost of milk production on Government farms and the price obtained by village producers in the Punjab, (per seer.)

	Cost at Government farms.	Rural producers' sale price.
	Rs. a. p.	Rs. a. p.
Cow milk	0 1 6	0 1 3
Buffalo milk	0 1 10	0 1 5

The comparison shows that the prices received by village producers are lower than the prices at which the milk is produced on the Government farms. In the absence of reliable figures, it is not known if the cost of production at villages would be less or more than at the Government farms.

It is also obvious that in any developmental scheme, the cost of milk production is of fundamental importance to safeguard the interests of the producers and in securing them a reasonable profit. It also helps to detect items which bring about unavoidable losses, so important from the national point of view.

A list of the latest prices of concentrates at different centres in India is given below to show the rise in the cost of this important animal feed. To work out the cost of production of milk under rural conditions of today a complete survey should have to be undertaken including such items as the cost of labour involved.

Price of oil-cakes at different centres.

	Per maund. Rs. a. p.
Groundnut oil-cake	
Bombay	2 3 3
Cawnpore	3 12 0
Linseed oil-cake	
Bombay	2 9 2
Cawnpore	3 12 0
Mustard oil-cake	
Cawnpore	3 12 0
Castor oil-cake	
Bombay	4 3 7
Cawnpore	3 12 0
Coconut oil-cake	
Bombay	3 4 11

All quotations are controlled rates.

V. Recommendations.

When taking stock of the conditions prevalent in India, we find.
The livestock in a state of semi-starvation.
Animal management very poor.
Milk production steadily decreasing.
Human population rapidly increasing.
Producers mostly illiterate, poverty stricken and perpetually under debt.
Price of milk is highest in the world.
Average income of the people amongst the lowest in the world.
Wide spread adulteration of milk.
Total ignorance of sanitation and complete indifference to hygienic standards.
Corruption and a very low standard of business morals very common.
Apathy of the general public.

In the absence of an organised industry capitalists unwilling to invest in this most important industry of the country.

Serious neglect of their duties by the public bodies.

Dairy equipment almost non-existent.

Absence of good pastures.

Lack of soil sense progressively leading in certain parts of India to soil erosion.

Yield of crops per acre low in the absence of modern methods of agriculture.

It is evident, therefore, that something more than a half heared national programme is needed to put this vital industry on a sund footing. Efforts made in the past lead one to realize that dairy industry as such could not be maintained as a separate entity. It depends on all round development of national economy such as agriculture, including on adequate veterinary aid and marketing control, industrialization, aforestisation, communication electricity, water supply, etc., etc. To reach our goal the problem must be attacked on two fronts, firstly we must improve the indigenous cattle. This involve breeding on scientific lines and the mangement of the cattle. It is indicated that the production of milk could be increased by 50 per cent through proper feeding, breeding and management and an effective disease control of the cattle already existing in this country, but increase in production cannot take place if the present chaotic conditions in the milk trade are allowed to continue and no incentive is given to the producer for putting better and more milk on the market. Salvaging of dry cows is another problem which must be tackled efficiently. Cows of good milking strain are finding their way to slaughter houses because when dry the economic condition of the owner does not permit him to retain the animals during this unproductive period. He is offered luctrative prices by the butchers which tempt him to make an immediate profit without regard to the future. The milk trade must be organised so that proper marketing of fluid milk and milk products can take place. Expansion of the fluid milk trade would give high and satisfactory returns to the producers. To step up the consumption rate per head of population a campaign for 'Drink More Milk, would have to be launched.

Recommendations on these lines have been thoroughly discussed in chapter VIII of the Report on the Marketing of Milk Published by this Department in 1943 which may be adopted with advantage.

V. (a) The main points of Chapter VIII of the Report on the Marketing of Milk.

To effect improvements in the marketing of milk in this country the first pressing necessity is to purge urban areas of their milch cattle and the second to organise effectively the collection and distribution of the rural supplies of Milk.

The monopoly of milk distribution should be given to one body. All available milk in the neighbourhood must pass through this concern. The retailers *viz., halwais*, dairies, etc., should be licensed and they should obtain supplies in wholesale from the above milk marketing organisation. Legislation be enacted to give the necessary powers to the local self-authorities. It is estimated that such a scheme, which will involve collecting, processing and distribution, would require Rs. 4,50,000 to handle 1,000 maunds of milk per day. This means that for a city with a population of about 2 lakhs persons the investment per head would come to roughly Rs. 2¼. As the capitalists may not respond officially to such a new venture, it is essential that the schemes be tried, in the first instance, on an experimental basis at a few centres namely, Karachi, Delhi, Bombay, Madras, Calcutta, etc. For operating the scheme

the required capital be found either by the Provincial government or the municipality concerned or by both. The scheme having proved successful, it is to be expected that at other places capital would be forthcoming from the investing public. When a number of urban schemes have come into existence in the province, a Provincial Dairy Produce Marketing Board be set up to co-ordinate and supervise their work.

The marketing organisation shall arrange for supplies from the neighbouring areas or from the adjacent areas as the case may be. Central depots will have to be established in the city for the processing of milk. Licensed retailers shall obtain milk at a wholesale rate on cash from such depots. To safeguard the public interest, the licensed retailers shall be required to deposit a security for observing the rules regarding retail sales. The Dairy Produce Marketing Board shall fix, in consultation with the interests concerned, all retail prices. The production of milk in the villages will be supervised by competent inspectors who will draw their salaries from this Board. To safeguard the quality of milk from the time it is produced in the villages to that when it is retailed to the public, suitable arrangements shall have to be made.

The icensing of retailers would remain exclusively in the hands of the municipality. The Food Adulteration Act shall be fully enforced and if a dealer is convicted under the Act on three occassions, he shall forfeit his license.

APPENDIX III (2).

(*b*) By Indian Dairy Research Institute.

ECONOMICS OF VILLAGE MILK PRODUCTION.

Consideration of the economics of rural milk production should be centred around the conditions of production of milk by the villager and the transport and distribution of the same under strictly profitable conditions. It is to be borne in mind that dairying as is practiced at present in Indian villages is at best a side line of the village farmer. The production of milk and the maintenance of milch cattle by the producer are limited by the consideration of the poverty stricken economy or the villager and he limited demand for cattle for his agricultural requirements. The quantity of milk production and the maintenance of milch cattle depends on the demand for fluid milk in the nearby market. This in turn in determined by the nearness of the locality to urban centres where the demand for fluid milk should be heavy. As such it is but natural that intensive milk production is to be encouraged and developed in such villages that are in easy reach of the urban areas and which are well connected with the same by easily accessible transport facilities. For the form of milk product marketed from a certain producing area is governed by the distance to the market. In places where there is no organised marketing, it can be said that cultivators up to 10-12 miles from a city will take their milk for sale in the city, using head loads, bicycles, horse drawn vehicles or rail for transport. Of greatest inportance is the time factor in transport and its effect on milk.

If a perfectly balanced economy is to be maintained in the rural milk production, based on the new developments of dairying the following points in systematising the conditions of production are to be borne in mind : (1) The type of milch cattle to be maintained by the Indian farmer is to be ascertained with a view to the nature of dairy product he can economically market. In areas that are situated near to urban centres the maintenance of heavy milking animals may be encouraged, keeping in mind at the same time the susceptibilities of the animal to the climatic and environmental conditions and the availability of the fodder requirements in the locality (2) The producer should be educated to feed his animals rationally. (3) He is im-

pressed with the necessity to produce milk in a hygienic condition both with a view to ensure the safety of the milk supply for purposes of consumption and with a view to ensure the life of milk during transport to the collecting and distributing centres. (4) Also he should be educated on the necessity to follow a uniform breeding policy. However it is to be understood that all these are to be done with a village producer, who is at present in ignorance of the importance of these considerations. This leads one to the natural necessity for the setting up of an efficient organisation that will educate the villager in all these matters. Taking into consideration the condition obtaining, one has naturally to turn to the co-operative system of production and distribution wherein the producer himself will be a sharer so that he may have a claim on the working of the same and may be entitled to the fullest benefits of the same. It is only when the village dairying is organised on such lines that it will be possible for the co-operative body that could look to the financial interests of the producer as well as the needs to the consumer that the rural dairy economy can be well balanced. For as such in the indigenous system of milk production, the villager has neither the means nor the resources to control his conditions of production and adjust the same to the demand. A co-operative organisation from the points of view of the producer should first assess the factors that influence the above mentioned points of production based on the conditions of market. It should be in a position to assess the quantity of whole milk demanded in the nearby urban area and fix up the distances, over which milk could be safely transported, the necessity for an intermediate processing at collecting centres and the machinery and form the distribution of the collected and processed milk in the urban areas. The quality of the milk produced should be efficiently controlled by the strict adherence to hygienic maintenance of milch animals hygienic milking and collection in order that the milk will be safely transported to the distributing centre. The mode of collection of the milk produced by the individual member of the production society as well as the different village units of a centralised urban society and the transport should take into consideration that the cost of collecting, processing transport and distribution of the milk should be paid down to the minimum. Such a thing would be well nigh impossible where the areas from which collection of fluid milk is carried out are not compact. Generally for minimising the cost of collection and transport, the following points merit consideration : (1) The bulked milk from the different villagers should be collected at a convenient centre or centres on a pukka road. (2) The amount collected should be sufficient to warrant the use of a quick method of transport such as a small lorry. (3) The milk should be subjected to an economical or of processing either at the collecting or distributing centre so as to enable it to gain in keeping quality. (4) Facilities should be provided at the distributing centre for cooling the milk and keep it at cold storage until distributed in retail.

All the above factors of production and distribution of village produced milk for retailing in the urban centres through the organisation of Co-operative dairying has been successfully practised by the "Lucknow Co-operative Milk Supply Union" (U.P.). The fist step taken by this union was to take a census of the milch animals in the villages around Lucknow and to make a survey of the methods of marketing milk and its products. From this survey the drawbacks in the indigenous method of production and marketing (consisting mainly in the indifferent maintenance and production of the village farmer and this utter dependance on the Halwais and middleman for their marketing) was realised. As the first constructive step the type of milch animal in the village was improved by buying out of co-operative grants animals from the Rohtak District (animals like Murrah buffaloes and Hariana cows) and distributing the same to the villages in circle.

Under the system of working of the union the unit of production is the village Society of which each producer is a member. The bulked-milk of this society is taken to a collecting centre. The village society manages its own affairs in the matter of (1) collecting the milch animals for milking improving conditoins of upkeep and hygiene of milking and handling milk etc. (2) the payment to each producer for his milk and (3) the buying of concentrated food from the parent society and distribution of the same among the villagers. There is a Panchayat to carry out these duties. The milk bulked in locally made cans is then conveyed to the collecting centre (within 2 to 3 miles from production centres) as rapidly as possible. As the collecting centres after assessing the quantity and quality of milk collected, the milk from different centres is bulked and sent after some preliminary heat treatment wherever necessary, to the central distributing city centre where the milk is pasteurised if raw, or cooled and distributed if already heat treated.

The working of the union has been satisfactory and it has been able to bring home to the villager the necessity to produce milk in a clean and hygienic manner which if adhered to will enable him to secure the best possible price for his milk. It has also looked to the maintenance of the type of cattle and other points affecting the economics of production listed. It has been possible for the union to disseminate scientific information to the producer and make him practise it so that the milk in some centres is fit to be transported over distances of 20 miles without any intermediary processing at the collecting depots. Such a step has gone a long way in reducing the cost of processing. Restricting the centres of production to a compact area has also helped in reducing the cost of transport. However, it is to be pointed out that in the initial years of establishment of the union it has to incur a loss because of the necessity for capital outlay in introducing hygienic methods and in villages and in helping the villager secure profitable and economical breeds of milch cattle.

Till now attention was drawn to the production and sale of fluid milk for whole milk supply to urban centres and the part co-operative unions can play in the same. However, in areas that are far removed from the cities the economy of milk production will have to be different in as much as it should relate to the preparation and sale of dairy products other than, fluid milk that would stand in good stead over long transport distances. Here the climatic conditions prevalent in major part of India restricts the nature of such products to butter and ghee that can stand longer than fluid milk. Here again a preliminary survey of the demand for butter in the market and the nature is to be ascertained. Whenever the product to be sold is butter or ghee, particularly when it is the latter, the maintenance of buffaloes or high fat yielding animals in such villages will greatly facilitate the balancing of the rural dairy economy. Also the establishment of co-operative organisations for the production and transport of such products will be of advantage both from the point of view of controlling the conditions of production by the spread of scientific information on the methods of production and from the view of securing and maintaining satisfactory modes of collections, transport and distribution.

Marketing of Dairy Products.

Dairy produce marketed in India can be classified into two main categories *viz.*, whole milk products that are manufactured from surplus milk and products that are made of one or more of the constituents of milk. The marketable condition of any produce is mainly influenced by the conditions of production which in turn depend on the aims of production and methods. Before considering in detail the nature and value of dairy produce it is worth considering the factors affecting the manufacture and sale of the produce. Dairying as practiced in India being of no

organised or scientific standing the villager is mainly guided by the cash out turn he may expect in the Sale. Such his first object is to find out a suitable sale for his milk as a whole. He keeps milk as such with or without processing till such a time that he is satisfied that he can no longer find a sale for milk as such. Part or whole of the milk that is left without sale is converted into *Dahi* or curd, in which form the individual villager can keep the produce for sale for a longer time than milk. As in the case of milk, curd or *Dahi* also cannot last more than a day or two under tropical conditions of manufacture and storage so on finding that in the form of *Dahi* it can no longer be marketed the same is turned into butter in which form the life of the dairy produce is prolonged for a few more days. But butter is also limited in its life and when it shows positive signs of deterioration it is melted into ghee which has the longest keeping quality of all dairy products. The above are the factors of production governing the manufacture of dairy produce in areas where the sale of such products extends to fluid milk, curd, butter and ghee. And this refers mainly to villages that are in easy reach of urban areas.

In parts that are far remote from urban centres the climatic conditions prevalent in major parts of the country coupled with the indigenous character of the cottage type of dairy industry limits the manufacture of dairy products to butter and ghee that have by far the greatest life of the common dairy products. Under such conditions the villager has to hand over his collected butter to the middleman, who after transporting the same to the market either sells it as butter or converts it into ghee and effects a sale.

It can easily be seen from the above enumerated conditions that in either case the villager is unable to get the maximum possible cash out turn of his products. In the case of the instance of the villager who is in the vicinity of urban centres due to the lack of any organised system of marketing he has to keep his milk till it reaches the verge of spoilage and make curd and butter or ghee of such a poor quality that they are not able to fetch him a maximum out turn. Also in the case of the dairy men in the interior villages, he has no ideas of the economic utilisation of his milk and has to make only butter or ghee (which respresent only a third or perhaps less the value of whole milk) and depend for its sale on the middleman who is not in a position to pay the villager even the reasonable price for his butter or ghee due to the uncertain condition of the product at the time its sale will be effected.

It is indeed obvious that this apathy on the part of dairy men is essentially due to the lack of any organised form of production and marketing. If only it is possible to assess the quantity of saleable whole milk in any locality and adjust the conditions of manufacture to the demand most of the difficulties could be solved. It is essential that this sort of indifferent conditions of manufacture should be immediately stopped if the dairyman has to secure the maximum cash benefits. For indifferent conditions of production lower the marketable value of the product. Milk intended for sale as fluid milk should be specially processed and stored in such a form that it will fetch the maximum possible price as whole milk. It is seen that in a particular area sale of fluid milk is not practicable due to local conditions the dairyman should be well advised to convert his surplus milk in to whole milk products such as *Khoa* if it is practicable. Otherwise if butter and ghee are to be the products marketed he should be made to convert his milk direct to butter or ghee without waiting to effect the sale as curd or milk. Such advise will positively enable the villager to fix up the dairy produce he has to manufacture and to concentrate on the preparation of the best quality product which alone could get him the maximum out turn.

Conditions of production as prevalent now could only be controlled by an efficient organisation of dairymen that will be able to assess the needs of the market and cater to the needs of the same. Co-operative organisations can go a long way in this connection.

Also the stimulus of the rural dairyman to manufacture the best quality product could be improved by fixing the grades of products and the price for the same. At present the Agricultural Marketing Board of India is trying to do something in this connection. But it is not all that is needed. The standards fixed up by this organisation does not cover all the dairy products and even the few that have been fixed for butter and ghee are arbitrary and non-practicable in few instances. In fixing the standards in a sub-continent like India with varying climatic conditions and the different conditions affecting the quality of dairy product in each distinct centre of production should be taken into consideration in fixing the standards. Also the Board should not be satisfied with fixing the standards of a lower limit for acceptance as in the case of ghee acidity but it should fix up different grades with differing standards so that the producer may be able to know the advantage of concentrating on better methods of production to arrive at the first grade product. The standards presented should not be limited to any one to two of the products such as butter or ghee but it should cover all the whole milk products and the bye-products such as *khoa*, chena, curd, casein etc. Fixing standards will be inaffective if the prices for the different grades are not also fixed. Further from the point of view of marketing, the advantages of the grading system should be brought home to the consuming public also that increasing demand for the best grade will stimulate the production of quality products and thereby enable the producer to get the most economic out turn.

APPENDIX III (1).

(*c*) By N. K. Bhargava, Dairy Development Officer, U.P.

Dairying in India is not taken as a business proposition. The producer maintains an animal or two to meet his domestic needs of milk and *ghee*. He does not maintain more milch animals firstly because his object in maintaining them is only to meet his domestic needs and secondly because he cannot maintain larger number of animals for want of economic holdings, non-availability of pasture lands and absence of efficient marketing. He does not worry himself with the fodder problem because he feels that it is the animals own look out to find feed for itself. Animals reared under such different and uncared for conditions produce little milk and the yield to the producer measured in terms of money is discouraging. This is a hard and bare truth which does not require any further elucidation. The producer having any surplus milk with him does not also get a fair price for it. This is not generally apparent to him in determining the cost of production as he is apt to ignore the gratituous services rendered by himself and the members of his family. Interest or indifference varies inversely with gains and losses in dairying. A close study of the conditions under which the milk industry is carried on at present will reveal that neither its production is economical nor is its marketing efficient.

Economic production in a village.—Economic production means producion of maximum quantity of good milk with a minimum of cost. The position of the milk industry as it stands to-day and the factors which influence the maximum production are briefly speaking as follows :—

(1) *Breed (milch breed.)*—The production of milk depends to a large extent on the breed of animals. If the animal is of a good breed the yield of milk shall be high but if on the other hand it is of a poor breed the yield of milk is bound to be low and uneconomic notwithstanding the efforts in other directions. At present

a cultivator produces 1—2 lb. of milk per day which is very uneconomical. To make it economical the production should be raised at least to 10 lb. per day. The animals of good breed are limited in number and even these are of stunted growth with poor milk yield. As a first step to attain our objective it is necessary both to multiply animals of good breed and to eliminate the poor one from the existing stock. This weeding will naturally relieve the present heavy pressure on fodder which will not be available in larger quantities to the animals of good breed and will also enable the producers to pay greater time and attention to their care and protection.

Closely allied with the elimination of poor animals is also the problem of the multiplication of breed. Experience so far gained in popularizing the imported breed under the existing conditions in rural areas confirms my conviction that it will be far more economical to the well being of the producer and conducive to the interests of the dairying industry in genreal, if the local breeds are developed by grading them with the Indian pedigree bulls, or in the alternative artificial insemination is introduced. The latter will be very economical and will bring in quicker results. Bulls in the village are almost invariably let loose. They feed themselves by raiding the fields of the cultivators and thus give rise to quarrels, with the result either the bulls are killed or the social relations in the village are severely strained. This will simultaneously require the castration of the scrub bulls in order to eliminate them once for all from the breeding category and facilitate the propagation of improved breed as stated above. The offspring thus obtained will serve dual purpose, which factor is very often overlooked by the generality of men. The imported breed proves expensive and unmanageable and does not flourish because of change in climatic conditions, and faulty feeding and improper handling.

2. *Feed.*—It is a familiar maxim of dairying that other things being equal yield of milk varies with sufficiency of food. Apart from periodical fodder famines there is every year a general scarcity of fodder in the months of December and January and again in April and May, the latter being the more acute of the two. The supply of milk is therefore considerably reduced during these months. The cultivator has no programme for feeding the animals throughout the year. The responsibility of feeding the animals rests on the owner whereas the latter shifts it on the former.

The problem of fodder is acute due to that the fact the average holding of a cultivator is very small *i.e.*, less than 5 acres. Naturally the cultivator is keen to utilize it for cash crops rather than reserve a portion of it for fodder crops. It is, therefore, necessary to take recourse to intensive cultivation to and introduce silage and the preservation of weeds. This may be further supplemented by balanced ration consisting of such concentrates as *chuni*, oil cakes and cotton seeds etc. Generally the cultivator feeds one constituent of the essential balanced ration more and forgets the importance of the other constituence of the feed, which makes it costly and wasteful.

3. *Condition of cattle.*—The general health of cattle in rural areas is very poor. Animals are generally short-sized and the yield of milk as already stated is very low. The main reasons are that the cultivator cares much more for cash crops than the cattle. He takes little or practically no interest in the breeding and feeding of his cattle. The usual practice is that instead of giving proper diet concentrates ration (*chuni*, oil cakes, cotton seeds etc.) to the cattle they are left stray in the jungle to find food for themselves. He is not interested in the production of milk but rears a number of them only for manure purposes.

Any plan of rural dairy development cannot be successful without a simultaneous emphasis on the breed and feed of milch cattle. It is, therefore, suggested that a co-operative organization should be established in order to encourage common feeding (concentrate) with common milking arrangements.

4. *Veterinary.*—In comparison to the demand and use of cattle the veterinary aid facilities in rural areas are almost nil. Every year the epidemics amongst them take a heavy toll. From the following table it will be clear how woefully veterinary aid has been neglected and how urgent the problem for its provision presents itself.

	No. of selected villages.	*Area square miles.*	*No. of milch cattle.*	*No. of dispensaries or welfare units.*
Lucknow	179	600	19,365	2
Allahabad	194	600	24,567	2
Benares	208	600	18,970	2

It is suggested that for every 20 villages a small mobile dispensary may be established under the supervision of a stock-man.

5. *Regulated and steady production of milk.*—The calving period of milch cattle as shown in the following statement, is the highest from September to November in the case of she-buffaloes and lowest from February to May. Correspondingly the buffalo milk is found in plenty for three to four months following Septemer and is scarce during the rest of the period particularly in the hot months of May, June and July :

Number of animals in milk August to December		*Number of animals in milk January to July.*	
Buffaloes	Cows	Buffaloes	Cows
269	142	124	318

Again most of the cows calve from March to April and few from September to December. Accordingly the cow's milk is comparatively abundant during the two and three months following March and is scarce during the rest of the year.

Thus the respective calving periods of cows and buffaloes serve to relieve each others' scarcity of milk but it is clear from the above that cows form a small ratio in comparison with buffaloes and thus the cow's milk forms only small percentage of the total supply of milk. Therefore the scarcity of buffaloe's milk is to be supplemented by the cow's milk. In order, therefore, to ensure steady supply throughout the year it is necessary that the cows and buffaloes should be kept in the villages in the ratio of 2 : 1 and the total production in a village should be at least 2 mds. per day. Nutrition is an important factor in bringing the time of covering closer but in rural areas the diet is so deficient that this period is extended beyond control and thus scientific and regulated calving is out of question.

6. *Quality of milk.*—Another thing as important as the breed and feed of cattle is the quality of milk. It should fulfil the requirements of the standard laid down for the consuming areas and should also be fresh enough to stand transportation over the distance involved.

It has been noticed that generally adulteration is the highest in summer—April to July—and the lowest in winter *i.e.*, from November to February. Two factors for determining the keeping quality of milk are :—

(*a*) adulteration with contaminated water

(*b*) unhygienic production of milk.

(*a*) Among the various methods of adulterating the milk that by water is by far the most important. Mostly, the dealers do not add fresh well water but that of canals, tanks and pools. As a result of enquiries conducted in villages it has been found that on account of the suspended impurities contained in water, the adulteration does not much lower the specific gravity of milk and the product easily passes as good milk. The specilfic gravity test being the only platform test which can possibly be performed, at the time of acceptance in the villages, fails to determine adulteration. Moreover, it has also been observed that in villages where the dairies are purchasing milk on the lactometer test, the villagers have started the addition of sugar which raises the specific gravity of milk reduced by the addition of water.

(*b*) In villages milk is produced under very unhygienic conditions. The sanitation of the village is very poor. Village stables are very dirty, animals are not washed, hands are not cleaned, milking pots are never well scrubbed and the water used is contaminated. All these combined give rise to undesirable bacteria which shortens the life of milk. Long life of milk is an essential factor in the long distant transport of milk.

Seventy samples were tested chemically and bacteriologically at Lucknow The results obtained which confirmed the above statement are given below :—

Sitapur Road—
38 Samples

	Within 4 miles of the road and 15 miles away from the consuming centre.	
Dudiha's milk	Samples brought by milk testers from villages.	
	Cows	*Buffaloes*
Fat 3·2%—5·8 %	13·9%—4·8%	5·1%—7·5%
SNF 6·154%—8·41%	18·5%—8·925%	8·55%—9·325%
PC 1·31m—3·12m	0·18m—0·5m	0·12m—·63m
PCF ALL 1 : 10 & 1 : 100	1 : 10—1 : 100	1 : 10—1 : 100
+ +	45%+30%	53%+41%
MBR 27 mts—58 mts.	100 mts. 300	120—324 mts.
*Acidity 0·12—0·17	0·11—0·14	0·12—10·14
	35 samples	40 samples.

*Low acidity due to adulteration with water.

Sultanpur Road—
32 samples

Within 4 miles of road and 15 miles away from consuming centre samples brought by milk testers from villages.

Dudihas	*Cows*	*Buffaloes*
Fat 2·6%—4·7%	3·4%—4·9%	5·0%—7·6%
SNF 5·98%—7·84%	8·54%—8·98%	1·9%—91·4%
PC 1·23m—3·7m	0·2m—0·61m	0·14m—0·61m
PCF ALL 1 in 100+ and 1 in 10+	1:10—1:100	1:10—1:100
	58%+48%	47%+32%+
MBR 17—145 mts.	90—210 mts	100—250 mts.
*Acidity 0·12—0·17	0·12—0·13	0·12—0·14
	33 samples	36 samples

58 samples were examined which were brought from a distance of more than 4 miles of the road.

Acidity 0·14—0·18
MBR—65 mts.—145 mts.
PC 0·43m—1·38m
PCF ALL 1:10+—1:100

	35%+
Fat	4·1%—6·85%
SNF	3·5%—8·91%

The villages which are about 30 miles from Lucknow produce a good quality of milk 47 samples were received.

Fat	5·5%—8·4%
SNF	8·6%—9·7%
Acidity	0·12—0·16 (pure milk)
MBR	185—365 mts.
PC	850 0—0·56m
PCF	1:00+1:100
	30%+5%+

From the above it will be observed that the keeping quality of milk depends upon:—

(1) The percentage of adulteration; the greater the percentage of water the lesser is the keeping quality of milk.
(2) Quality of water used for adultertion.
(3) Cleanliness and the nature of the utensils used.
(4) Prevailing hygienic conditions under which milk is—
  (*i*) produced,
  (*ii*) handled, and
  (*iii*) transported.

The present average life of milk in a village is about 3 hours which is insufficient for long transport. The average minimum life should be 5 hours.

To remove the defects it is recommended that joint milking in a sanitary common milking shed should be introduced. The animals and the hands of the milkers should

be cleaned for safe-milking in well scrubbed utensils under the supervision of the panchayat of the society. This will prolong the life of milk. Experiments carried showed that the milk produced under these conditions had a life of over five hours.

7. *Water.*—Water is by far the most important item not only to the dairy industry but also to the villagers. Plenty of clean and fresh water is very essential for the health of animals, cultivation and cleaning utensils apart. Mostly the villages have *kachcha* wells which do not provide enough water for irrigation, drinking and washing purposes to the animals and cleaning utensils. The experiments carried out in the villages have shown bacteriological counts due to which the contamination of milk comes from the polluted water generally used in cleaning the utensils with the pond and *nala* water. Once the milk is thus contaminated, the quality of milk deteriorates and the loss caused cannot be remedied.

Where water is scarce, buffaloes cannot be cleaned and are always seen besmeared with mud. The animal is milked in the same condition and the contamination is passed on to the produced milk lowering its keeping quality. It gives heavy sourage at the consuming centre and officers difficult problems to the chemist to overcome.

The contaminated milk gives rise to various types of diseases among the consumers. The need for a *pucca* well under the common milking arrangement is therefore obvious.

8. *Containers.*—Different types of containers are used in the milk trade at its different stages. For milking purposes brass pots called *batloies*, earthen pots, and galvanized buckets are used. For collecting handling and transporting, metal pots generally of brass, earthern pots, galvanized iron cans, buckets and second-hand kerosene oil and other tins without lids are generally used. To save splitting grass or leaves are put into the containers and they serve the purpose of lid. The capacity of these vessels used for milking and transporting is usually 3 seers (6 lbs.) and 20 seers (40 lbs.) respectively.

The vessels should be of metal, free from crevices in between joints (as they are difficult to be cleaned) lest they should give rise to bacterial contamination. Earthen pots and polluted water should never be used. Lids on the vessels are very essential at all the stages.

9. *Weights and Measures for milk purposes.*—In the villages milk is always sold by volume and in cities by standard weights. Wholesale prices are generally quoted in seer per rupee. The cubical contents of the measure are found to vary from village to village in the same Tahsils, and District to District from 17 ch. to 22 ch. Sometimes the *dudihas* or milk contractors take undue advantage of the ignorance of the villagers by increasing the capacity of the measure in use by producing their bottom outside. The introduction of standard weights and measures is suggested.

10. *Transportation.*—Regularly, cheapness and speed are the three essentials for transport of highly perishable bulky commodity like milk. In India due to warm climate the trasnport of milk has to be undertaken twice a day— morning and evening. The mode of transport depends upon the quantity handled and the distance of the producing centre to the collecting centre and from collecting centre to the consuming centre.

Main forms of transport are :

(1) Head load,
(2) Shoulder stings (*bengis*),
(3) Bicycles,

(4) Boats,
(5) Tongas,
(6) Railways,
(7) Lorry.

For the transport of milk from the producing to the collecting centre the *bengies* and bicycles may be employed because they carry the maximum load of one md. milk at a time in shorter period at economical rates. It is better to encourage cycle transport in villages as far as possible due to its speedy service.

Lorries or railways may be employed for early transport from the collecting centre to the consuming centre over long distance.

11. *Rural Finance.*—People in the villages are poor, the resources being quite meagre. Their present mainstay *i.e.*, agriculture due to various circumstances leaves very little with them to either make any long term investiment or even carry on their day to day expenses. They are unable to meet the expenses required in connexion with the purchase of improved milch animals, machines, etc., and bear their daily expenses of maintenance of animals. The financial position of an average villager, representing one family, can be known from the following figures about the maximum and normal credit, as found in some of the milk societies.

Serial No.	*Name of Society*	*Average M.C. per member*	*Average N. C. per member*
		Rs.	Rs.
1	Saniavan	100	80
2	Banauga	140	110
3	Akbarpur	150	120
4	Dundpur	145	105
5	Hirpur..	140	100
6	Dairyapur	150	110

It will appear from the above that on an average the normal credit of a member does not exceed Rs. 100 and his maximum credit is near about Rs. 150. The advances are generally made up to the limit of the normal credit of a member. This limit is hardly sufficient to cover the risk involved in the advances for the purchase of an improved animal costing about Rs. 200 to Rs. 400, but if we have to carry a development programme, it is essential that the advances for the purchase of improved animals must be made, irrespective of the credit limit. The primary societies should be given the choice of making advances to their members irrespective of their credit limit, but in the interest of safety of the money advanced, the societies may be asked to have the animals purchased from the advances pledged to them and get the animals insured.

The ligitimate financial needs of the people in this connexion are :—

(1) *Long term credit.*—It will be required for permanent improvements, *e.g.*, starting of pasture lands, sinking of wells, acquiring of land and provision of sheds etc. for common milking.

(2) *Short term credit.*—It will be required for the finance of day-to day requirements *e.g.* for the purchase of fodder and *khali*, etc.

(3) *Intermediate credit.*—It will be required for the purchase of cattle chaff-cutters and cans, etc.

For nos. 1 and 3 Government *Taqavi* shall be necessary which may be advanced interest free through the societies. For item no. 2 the co-operative milk society may itself make advance to its members and may in its turn obtain short term finance from the central union, to which it may be affiliated.

12. *Education.*—The greatest obstacle to the successful running of any scheme is the illiteracy of the villager, his lack of foresight and subservience to age old customs and out of date tradition. The introduction of a new scheme involves a fight against all these evils. Lack of education has killed his business initiative and a villager is more apt to acquiese in his fate than to fight out its cause. One has to radically change the outlook of the villager in combating his short-comings.

In order to achieve this object, it will be necessary to do a great deal of propaganda with the help of leaflets, magic-lantern show and organizing group conferences now and then. His method of maintaining the animals is very dirty and it will be necessary to show and teach him hygienic and healthy methods. He will have to be shown common milking through the magic lanterns. Generally group conferences of the societies shall have to be organized, where everything in details is explained to them.

Education and demonstrations on the lines of folk schools in Denmark, should be organized for educating the producers in the method of clean production, handling and breeding of animals in particular.

13. *Marketing.*—Maximum production of milk is very intimately connected with the price that the cultivator gets for his produce in the market. Paradoxical though it may seem, the consumer in urban area pays a higher price for a comparatively lower quality of milk. The reason is that milk marketing as a whole is in the hands of hoards of petty milk dealers who cater door to door supply in driblets after going through the same process at the source of production. This inevitably results in higher costs sf collection, transport, handling and distribution of milk. To meet the increased cost they have to take recourse to adulteration which is the only handy means available for them. This system is disadvantageous both to the producers and the consumers. The producers suffer because they do not get a fair deal in the matter of rates, measurements and payment of price. The consumers too suffer because they pay a higher price for the stuff which is not genuine although it passes as such. Apart from these evils the system also does not inspire confidence either in the producers or in the consumers, so far as the regularity in daily intake and delivery and the fluctuation in prices are concerned.

There are obviously two alternatives to improve the present marketing arrangements in the interest of the producers and consumers alike and the dairy industry in general. Firstly a central authorized marketing organization may be established at the consuming centre for the distribution of milk with a number of depots established in the villages for the purchase and collection of milk. This will be nothing short of a capitalist organization with its inherent evils of profit motive and vested interests and will not in the long run prove beneficial to those whom it is intended to serve. The only alternative is the co-operative method under which the producers may be organized into their societies and may further have a Central Co-operative Organization of their own in the consuming centre with representatives of the producers and consumers working together for common interest to their mutual advantages. We in the United Provinces have formed such organizations, Central

and Primary, in recent years, particularly in the Lucknow and Allahabad districts and have achieved a certain measure of success. They have tried to save the producers from the underhand dealings and mal-practices of the *dudhias* or milk contractors and ensure the consumers a better quality of milk at a reasonable price. The success we have received so far has justified the experiment and offers hopeful promise for the future. It may be frankly stated that even this co-operative machinery got a serious set-back during the war time when military contractors were let loose in the rural areas to purchase milk at any price irrespective of the quality. The cut-throat competition with the military and subsequent with other small and petty milk dealers with their vested interests has emphasized the need of establishment of a single Central Co-operative Organization at the consuming centre solely authorized to deal with the consumers and a net work of co-operative organizations in the villages for production and collection.

These organizations will by virtue of their standing and status be able to handle large quantities of milk and thus effect economy at all stages from production to distribution, the result of which will be the lower price to the consumers and higher price to the producers and the improvement in milk industry in general.

Summary of suggestions.

GENERALLY in non-breeding tracts a large number of uneconomic animals is maintained. The weeding of such animals is necessary to reduce the strain on the fodder resources, good milkers are to be encouraged, (Para. 1.).

2. Local breeds should be improved by crossing them with the pedigree Indian bulls. (Para. 1.)

3. Pedigree bulls in the villages should be introduced or in the alternative artificial insemination may be resorted to. (Para. 1.)

4. Compulsory castration of the animals at an early age should be introduced (Para. 1.)

5. In order to reduce the cost of production and collection a producer must produce at least 10 lbs. of milk per day. (Para. 1.)

6. The average agricultural holding per head is below 5 acres. It is too small and scattered a holding to maintain a pair of bullocks and milch animals, It is, therefore, necessary to devise ways and means to consolidate holdings and increase the productivity of land. (Para. 2).

7. It in recommended that during the scarcity period the conservation of fodder and the introduction of silage in the diet of animals are essential. (Para. 2.)

8. There is very little knowledge among the villagers regarding the supply of green fodder to the milch animal. The cultivation of perennial grasses should be encouraged (Para. 2.)

9. Breeding combined with feeding can only improve the strain of milking in the animal and a balanced ration is recommended. (Para. 2.)

10. Common feeding simultaneously with common milking under co-operative organization is also recommended. (Para. 3.)

11. A small veterinary dispensary for a group of 20 villagers in charge of a stockman is recommended. (Para. 4.)

12. In order to have a continuity of milk supply the maintenance of both the buffaloes and cows is essential in the ratio of 1 : 2. (Para. 5.)

13. A village must collect 2 maunds of milk per day. (Para. 5.)

14. Arrangements should be made for washing the animals and cleaning of the hands of the milkers before milking. (Para. 6.)

15. For clean and abundant water supply for the production of milk, the construction of one *pucca* well in each village is recommended. (Para. 7.)

16. The use of earthen posts and other cheap vessels may be discouraged. The introduction of metal vessels without crevices is recommended. (Para. 8.)

17. Lids of the vessels should be used at all stages of handling of milk. (Para-8.)

18. Standardization of weights and measures is suggested. (Para. 9.)

19. There must be efficient arrangement for the quick transport of milk from the village. The use of cycles which are the best and cheapest means of conveyance should be encouraged. (Para. 10.)

20. It is necessary to economize time in milking, collection and transport and control adulteration. (Para. 10.)

21. Feeds and concentration rations may be purchased jointly in order to reduce the overhead charges. This should be done through a co-operative store in a village (Para. 11.)

22. The introduction of chaff-cutter among the producers to reduce the cost of feed is suggested. (Para. 11.).

23. Arrangements may be made to advance long term and short term loan to members for the purchase of animals and feed at cheap rate of interest. (Para. 11.)

24. Insurance of cattle is to be introduced. (Para. 11.)

25. Propaganda for making the villagers improvement-minded through magic lantern lectures, shows and group conferences, etc., and introduction of folk schools on the lines of Denmark are recommended. (Para. 12.)

26. Legislation to prohibit milk production within the municipal limits is recommended as the cost of production is high and forces the producer to adulterate (Para. 13.)

27. For linking production of milk with marketing the establishment of a central Co-operative Organization in the consumisg centre is recommended. (Para. 13.)

28. Formation of a Co-operative Society in each village is recommended for economic production, handling rat ansport of milk. (Para. 13.)

APPENDIX. III (1)

(*d*) By SODHI GAMBHIR SINGH, B.Sc., (Ag.)., C.D.D., N.D.D., P.V.S., (I), DAIRY DEVELOPMENT OFFICER, Pb.

Zamindars in villages keep milch cattle primarily to produce milk, ghee, etc., to meet their home consumption. Of course, in villages near towns and cities gujjars (milk producers) keep the milch cattle as their main occupation of livelihood. In both cases, the farmers and gujjars (milk producers) in villages do not keep mlik records and supply only vague information which is of little use to work out the current cost of milk productoin. In order, therefore, to study the economics of milk production in villages one has to refer to the main items of the cost of milk production. The main items are :—

1. Feed.
2. Labour.
3. Cow cost.
4. Bull cost.
5. Buildings.
6. Equipment.
7. Miscellaneous.

Taking the above points into consideration, it can be deduced that milk is produced more economically in villages than in cities because :

(1) The bulky feeds (green and dry fodders) are grown by the Zamindars in their own lands and have not to pay freight charges to cart the same from long distances. Similarly, most of the concentrates (excepting oil cakes) required to be fed to dairy animals are produced at the farmers' lands. Thus the fodders and concentrates cost much less to milk producers in villages than in cities. Again it is an admitted fact that the item of feed alone represents about 50% (Fifty percent.). of the total cost of milk production. Hence due to low cost of feed, alone, the milk is produced cheaper in villages.

(2) The manual labour required to attend to milch cattle is comparatively cheaper in villages as compared with cities. The manual labour forms about 20% of the total cost of milk production and labour being cheap in villages, the cost of milk production is reduced.

(3) In villages the milch animals live in an open airy atmosphere with sufficient lands to roam about for exercise. So they (milch animals) remain healthy in villages and produce comparatively more milk for the same feed and labour. This is another important factor which reduces the cost of milk production in villages.

(4) In villages there is not much trouble to have a bull for service of milk cattle (in heat) while in big cities sometimes the bull is not available for immediate service with the result that the dry period of milch animals is prolonged. The longer dry period affects the milk production adversely.

Improvement of Marketing the Dairy Produce.

It has been stated above that it is economical to produce milk in villages, but it cannot be lost sight of that there are certain serious defects in the production of milk in villages. For example :—

(*a*) No heed is paid to milk clean production.
(*b*) The milk is put in shabby utensils (cleanliness of which is very difficult.
(*c*) No care is taken for proper handling of milk.

Due to unclean production and defective handling, the milk often gets spoiled and it is very difficult to say if it is safe for human consumption (as it may contain pathogenic bacteria). Again the marketing of milk is mostly in the hands of illiterate unscrupulous people who purchase milk from villagers at cheap rates and often adultrate it with water (more often with muddy dirty water so that lactometer meter reading may not become low) Further transport means are not at all satisfactory.

In order to effect improvements in the marketing of milk, the following suggestions need immediate consideration.

1- Education of Milk Producers, Dealers and Consumers.

(*a*) The milk producers in the villages should be made aware of the advantages of clean milk production and should be taught the methods for producing clean milk by arranging short lectures and by giving practical demonstrations in the villages: To achieve this object, Dairy Assistant Propagandists will have to be appointed by the Government and the Dairy concerns. This is most important as unless and untill clean milk is produced, it is apt to be spoiled and cause diseases.

(*b*) The Milk Dealers (Dairy concerns), who are engaged in the collection, processing (if any) and distribution of milk must be honest people who know the importance of cleanliness in milk trade. They must be taught (if they have not already received training in dairying) the principles underlying the science of dairying and its trade.

(c) The milk consuming public must be made to realize the necessity and to appreciate the value of pure milk. It is essential to create the right public opinion in favour of pure milk supply and to achieve this object vigorous propaganda by mean of lectures and practical demonstrations should be done.

2. The milk marketing organisation must be improved to ensure a satisfactory price to the producers as below :—

(a) The milk producers in the villages should be organised in form of clean milk producing societies and these societies should be organised by the village Panchaits or Cooperative Department under the guidance and advice of Dairy Section of the Veterinary Department. The clean milk producing societies should aim at producing clean milk and to sell their milk to Milk Importing and Distributing Companies Ltd. These Societies should have some common place to collect the surplus milk for sale.

(b) The Milk Importing and Distributing Companies Ltd., should be organised. These private concerns will deal with the import of milk from villages and for distribution (after proper processing) of the same in cities to milk retailers and milk concerns. The right of importing processing and distributing the milk shall be vested exclusively in these milk importing and distributing organizations (For details please read Milk Legislation).

(c) The present milk retailers (*i.e.*, Halwais and Dairies, etc.), in the cities and towns should continue to function but they must get license and obtain their supplies exclusively from the approved importing and processing and distributing Companies.

3. *Legislation* is essential for the pure milk supply of the cities and towns and the following require immediate attention.

(a) The pure Food Act penalising the sale of adulterated milk and milk products should be modified. The standards of the different kinds of milk should be revised to suit the Indian conditions.

(b) The Legislation should provide for the right of importing and distributing the milk vested exclusively in duly authorized organisations and requiring milk retailers to purchase milk from the duly authorized marketing organisations. This measure is essential to get rid of unscrupulous people who use all sorts of illicit measures to compete with right type milk dealers.

(c) The production of milk within city or town limits should be prohibited. This measure should first be enforced for milk being produced for sale and immediately the supply of pure milk in the towns and cities improve, the private individuals who produce milk for home consumption should also be prohibited to keep milch cattle within Municipal limits. If for certain religious sentiments, the second part of legislation is considered unpractical, then conditions regarding hygienic housing and proper feeding of milch cattle owned by private individuals for the production of milk for their home consumption must be enforced.

4. *General.*—(a) The milk producers should be supplied oil cakes, bran etc., on concession rates (say 25% less than market price and 25% cost of the concentrates may be shared by Government of India and Punjab Government 50 : 50 in Grow More Food Scheme exactly on the same basis as Fertilisers are being supplied to the zamindars. This will improve the feeding of milch cattle and thus increase milk production and the villager will be able to produce more economically.

(b) Dairy Trucks may be similarly given at half cost price to the approved milk marketing organisations. The half price may be shared by Government of India and Punjab. This will improve the milk transportation.

(c) The arrangements should be made for the manufacture of cheap country dairy utensils and milk cans which could be cleaned and sterilised easily. This point requires special consideration, since the villagers are not willing to purchase postly dairy utensils ; and the utensils which they use at present for the purpose cannot be cleaned easily. The firms that undertake the manufacture of cheap dairy utensils of approved type (the Dairy Section could approve the same) should be subsidized.

N.B. In order to see the proper working of the scheme for the supply of pure milk in the cities, Milk Boards should be set up in each Municipality or Corporation. These Milk Boards will act as Advisory medium to the public (milk producers and dealers and consumers) and to the Government from time to time. The constitution of these boards will be as under:—

1. Three members from Village Producers.
2. Two members from Dairy Farms.
3. Two members from approved milk importing processing and distributing Companies.
4. Two members from Milk Retailers.
5. Five from amongst milk consuming public.
6. One from Dairy Section of Veterinary Department.
7. One from Health Department (who will act as President).
8. Three from Municipal Commissioners (One out of these will act as Secretary).

Total.....19.

APPENDIX III (1)

(e) By N. R. Joshi, B.A., I.D.D., Dairy Development Officer, Central Provinces and Berar.

The subject on which I have to initiate discussion is that phase of animal husbandry in which one has to mostly grope in the dark, for due to dearth of sufficient published information based on facts and observations one has to draw mostly upon his personal impressions only. The exploratory work done on this phase of dairy industry on which the entire theme of animal husbandry development in a large part of the country rest is so cursorily surveyed and the actual published work so comparatively meagre that it is beyond one to preface his opening remarks with a detailed prices of the available knowledge on the subject as is customary in such discussions. Whatever, therefore, is brought out in my preliminary opening remarks is a collection of scattered personal experiences in this field of work during the course of my professional activities. I do not offer any apologies for the scanty material that I am placing before you for the plain reason that I myself have very little to fall back upon.

2. The first half of the subject which we are dealing is far more difficult of critical analysis not only on account of paucity of data but mainly due to the fact that so much of economics of village milk production is "beyond economics". By this I mean that common yardstick with which we usually measure the economics of a commodity fail in assessing the real economics of milk production, in our villages. Production costs which enter so largely in and influence supply and demand of a commodity and partly determine the market price are rarely taken into consideration in producing milk in rural areas beyond suburban areas. Even a superficial study will reveal that it is the subsistence cost of the milk producers that largely enters milk production costs than the cost of production of milk itself.

3. My observarions here are limited to conditions prevailing in the Central Provinces and Berar and may apply to conditions in certain parts of the eastern United Provinces as well. In the Central Provinces and Berar over 95 per cent. of the cows and about 90 per cent. of the buffaloes are in rural areas beyond the influence of urban and suburban areas, the proportion of cows to buffaloes being 4 : 1. Here there are three main classes of people who maintain cattle and the economy with which these are maintained differs with these classes. Firstly, there are *gaolies*

akin to *Ahirs* of the United Provinces, who primarily depend on cattle for their maintenance and are in majority of cases not connected with cultivation. The second class of people are the cultivators, who maintain a few animals besides bullocks. The third class comprises of big landlords or malguzars who maintain sufficiently large number of cows and a few buffaloes. All the above classes have slightly differing husbandry though the net result in the economy of milk production is not a great deal different. *Gaolies* as a rule maintain herds of cows, and/or buffaloes, numbering 5 to 50 and at times even larger than this. In majority of cases they have no land for cultivation and as such have to depend mainly on grazing lands. They move away from their homes wherever adequate water and a little browsing for their cattle is available. The only cash expenditure they have to incur over their animals is in the shape of grazing fees to be paid to malguzars or to Government Forest Department. Besides this expenditure which does not amount to more than 4 or 5 rupees per annum, per animal, they spend about a rupee or two in purchasing salt for the animals. Concentrates are rarely fed. Lactation period of their animals is inordinately short, rarely exceeding six months. Milk is converted into butter or ghee and sold in the nearby market. *Lassi* is either consumed by the family or fed to animals. In certain tracts *lassi* is also bartered for grains and thus part of the year *gaolies* families obtain part of their food through this source. On the basis of ghee it is estimated that average production per buffalo is about 30 to 40 lb. per annum while it is approximately 5 to 7 lb. per cow which at present rates of ghee brings in a cash income of about Rs. 40 per buffalo and Rs. 7 to 10 per cow.

As far as the cultivators are concerned husbandry differs with them in as much as the cattle do not migrate far from their homes. Cattle eke out their existence on the nearby Government as well as malguzari forest areas and also on roadside and field *bandhies*. Further, these cattle are given partial stall-feeding but there is a gradation in this. *Kadbi* and straws, the bye-products of farming are utilized in order to preference for bullocks and buffaloes and then for other animals including young stock and cows. Part of the fodder may be sold for cash returns. In cotton tract some better class of farmers reserve a part of their fodder for feeding to other people's herds which are made to stay in their fields and thus manure the land. Cultivators as a rule feed some concentrates to their bullocks and buffaloes but rarely to cows or young-stock. They maintain milch animals because it gives them a chance to utilise the bye-products of farming operations and at the same time it makes available some currency at regular intervals for incidental and necessary purchase. This dribble of currency has a much higher real value to him than its face value. The third class of cattle husbandmen are landlords or malguzars. They maintain sufficiently large herds of cows and a few buffaloes. Cows are maintained mainly for manure and also for production of bull calves to replace their draft bullocks. Majority of these cows are rarely milked. Only buffaloes are looked upon as a source of milk and ghee for family use. Surplus is sold. Almost all the animals, except bullocks and buffaloes, are dependent solely on grazing lands, either owned by them or Government forests. Bullocks and buffaloes are partially stall-fed and given small quantities of concentrates. I have already indicated above the income that accrues from cows and buffaloes from their milk. Manure income is unassessable. Cows though producing small quantities of milk and thus yielding less incomes to their owners compensate this by incomes from bull calves. According to the latest census figures for the Central Provinces and Berar, the net gain to the bullock power from 100 cows is about 16 per annum. At the present market rate for bullocks which is Rs. 75 to 100 it would mean an income of Rs. 1,200 to 1,600 per 100 cows or Rs. 12 to 16 per cow.

4. It will be seen from the above that though returns from milch animals are extremely low the expenses entering this production are lower still. At this rock bottom economy any improvement suggested do not yield compensatory returns. The result of this is well known. Poorer returns and still poorer cattle build a vicious circle. Starting with the premise that a milch animal is an agent of production of a marketable commodity and hence has to be economic does not seem to work in our rural economy as all production improvement, must aim at lowered cost of production while the improvements suggested do not immediately achieve this. The reason may have to be sought in another direction. The cattle in India are knit largely in the social fabric and they have to be treated as such. Once we recognise that milch animals are part of the society and as such have to be regenerated, improvement schemes largely become State obligation.

We may arrive at the same conclusion from another line of reasoning as well. An individual cannot influence the forces external to his own business including the price of his product as well as the prices of products such as cattle feeds, etc., which are so essential to him. He, therefore, utilises his productive resources in such a way that he receives the highest possible returns for his subsistence and that of his family and cattle. Cattle improvement plans, such as better-feeding, breeding with better bulls, etc., though designed to bring in additional income through larger output of product from cattle, demand larger cash expenses. Balancing this increase in cash expenses against additional income the farmer may find (and this to a very limited extent is borne out by actual observations in our limited developmental project at Jhallar) that he cannot increase his returns over expenses by increasing his output. The perpetual stress for increasing the income, therefore, may dictate an adjustment which, as a short range policy, may be in the interest of family and business survival but may be quite contrary to the larger group interest. State intervention is thus necessary to deal adequately with such a situation and to assist the individual in the interest of the group as the State is better able to strike a balance in favour of futu income than the individual himself. If we accept this principle of State taking over this responsibility in the interest of the society, the pace of improvement schemes, can be definitely accelerated, keeping in view the limitations of State itself. Supply and maintenance of approved bulls, subsidized maintenance of selected graded stock, rehabilitation of our forest and grass lands with a view to supply optimum feeding facilities, fodder growing and conservation, formation of co-operative organisations with a view to supply the necessities of farmers as well as production of quality dairy produce and its marketing, effective disease control through adequate staff, have all to be achieved with an eye on the future rather than immediate returns which at present is the sole objective of our economically hard-pressed farmer. Here then comes the necessity, in a phenomenally poor rural economy, for the State to step in for assistance with all its possible resources. In other words, the State itself has to invest adequately where the farmer with his limited means cannot afford the initiative himself with a view to build up the future farmer who in a short space of time will himself be able to bear the burden of progressive improvement.

5. The latter part of the problem refers to the marketing of dairy produce in a way as would enable the producers to secure the maximum returns. Here again I restrict myself to the field I am conversant with. The Central Provinces and Berar in normal times is not much of an exporting province for ghee. We have mostly to think in terms of satisfying our own markets. Figures collected from terminal markets in the province and rural areas show that the price spread between the producers return and consumer's price is not substantial. Producers actually get anywhere from 75—80 per cent. of the consumer's price. Seemingly, this does not

reflect a large amount of middleman's profit as the operation costs for transportation, packaging, retailing, etc., may amount to 12 to 16 per cent. But the real profits of the middlemen lie elsewhere. It is true that dislike of middlemen is as old as history. This eternal tendency to distrust the agencies of distribution and to suspect them of profiteering is the psychological basis upon which our producers, co-operative organisations are being built. Though a seemingly the middlemen's profits look moderate it does not mean that middlemen are really giving a square deal to the producers. If they were just handing over the real goods to the consumers, the objection against them would not be so strong but it is common knowledge that they do not do so. Besides the middleman is shrewed enough not to load his profits on one commodity alone. The result is that though the villager is fleeced in a variety of ways he seldom realises the cumulative effect of the operation. Co-operative societies who have constitutional limitations are at times unable to counteract this multi-pronged attack of the middleman. Thus, though the co-operative marketing is to be encouraged, mere substitution of the middlemen by these organisations will not go a long way in increasing the returns to the primary producers unless the hands of the co-operatives are strengthened through a flexibility of constitution and State backing. Along with co-operative effort the following plan of action should accelerate the progress of the development work leading thereby to enhanced returns to primary producers :—

(*a*) *Grading and standardization of products.*—A large scale movement in this direction is essential. Probably in the initial stages State would be required to assume entire responsibility till the volume handled justifies its legitimate charge on the product. Civic organisations in the past have miserably failed in this direction, and the only hope lies in State control. A word regarding imitation dairy products will not be out of place. It isof vital interest to the dairy industry as well as the consuming public that adequate legislation should be enacted for controlling the production and distribution of imitation dairy products. The question of levying an excise tax on ghee and other dairy product substitutes which complete with dairy products needs examination.

(*b*) *Reorganization of terminal markets.*—Regulation regarding retailing of dairy products under stipulated conditions along with price control should be very helpful. Notification of areas of production and purchase and even monopolistic marketing may be necessary. Public regulations as provided for public utilities will ensure increased efficiency and reduced distribution costs.

(*c*) *Transportation facilities and reduction in freight rates.*—Efficient and quick transport for movement of dairy products is of supreme importance. State controlled motor and rail transport will materially assist in achieving this objective. Not only has the farmer to bear the cost of transport of his final produce, *viz.*, butter, ghee, etc., from rural to urban areas but also of the feeds which enter into his cost of production. At present these have to be transported from urban to rural areas as bulk of the concentrates for cattle, which are the byeproducts of milling and oil industries are largely, produced in the urban areas. Ruralisation of these industries on co-operative basis in the interest of national economy appears essential. Extension of road and railway facilities and even subsidization of transport of fodder appears necessary in many parts o the country for a co-ordinated cattle improvement drive.

(*d*) *Effective check on speculation.*—Both dair products as well as cattle feeds such as cotton seed, oil-cakes, *chuni*, straws, grass and *kadbi* are constantly facing the onslaught of speculation. This ultimately leads to uncertainty regarding cost of production and inflation in the prices. Regulatory State control is essential in order to ensure adequate protection both to primary producers as well as consumers.

(c) *Rural credit.*—Both short term as well as long term rehabilitation loans on easy terms will be necessary. It is possible that a certain percentage of these loans may be irredeemable in the initial stages but unless the state handles this problem whole hog and adopts a bold policy in which risk is inevitable, it is futile to expect rehabilitation of our present disrupted and disjointed rural economy.

6. In the above brief and sketchy presentation of the subject I have endeavoured to bring out some essential problems of our existing rural dairy economy. The subject is so vast and beset with so many complexities that it is beyond the scope of a paper like this to deal exhaustively with all its bearings. This attempt is just, therefore, intended to formulate a basis for a fruitful discussion which, I feel certain, will be enriched by experience of workers all over the country and ultimately lead to the chalking out of further specific lines of action.

APPENDIX III (1)

(f) By Dr. J. K. Makhijani, Livestock Officer in Sind, Malir.

Two aspects of the subject are required to be discussed in the present note, *viz.*, the economics of village milk production in India and the marketing and disposal of milk and milk products.

Production of milk in Indian villages suffers from numerous handicaps. Cow keeping in villages is taken generally as a side line to the main agricultural occupation of the cultivator. This subsidiary occupation provides him with his scanty needs of liquid milk and the *lassi* (butter milk) and whatever the reserve, he converts into butter and ghee, which (the latter) is stored and sold to the village *Bania* who pays the cultivator a very nominal rate. Due to poor or no return from milk produced in villages, the cultivator or individual *maldar* (cattle owner) takes no interest to feed his animals. He does not look upon it as a business proposition. The village maldar would not like to undergo any out-of-pocket expense to feed his cows or bullocks. The farm-refuse is perhaps all the feed that the cultivator may provide to his cattle supplimented by sparing grain feed or oil cake, if at all. This has led to general, malnutrition of young and growing stock as also of adult performing animals, resulting in gradual deterioration of all the stocks—thus making them uneconomical producers of milk. Right (1940) reported the yield of village cattle averaging to about 600 lbs. per year which is admittedly a very low milk yield for a cow. An increase in milk yield will lower the cost of milk production by spreading maintenance costs and costs of depreciation and labour over a large out put of milk.

A lot has been said and discussed about the economic position of the village *maldar*. The machinery where the milk is produced and disposed of as also the costs of production, transportation, if marketing agencies and the selling rates to the consumer do vary from tract to tract but the position, in main, is just about the same throughout the country. Certain surveys have been carried out in various parts with the view to studying the position of milk production and consumption notably the village enquiry carried out in 1939 by the I. C. A. R. in seven breeding tracts in India. More careful and authenticated surveys are now proposed under the new Dairy Development schemes proposed for various provinces. The writer feels that no useful purpose will be served by giving results of some of these surveys already carried out as no effective measure towards solution can be suggested in consequence, until the *basic economic structure of the village maldar is altered.* And this is possible only when the average production of milk per cow is substantially raised. That, in my opinion, will move the village maldars and will give him the required impetus to take interest in the milk trade. There is no doubt that the present machinery of the disposal of milk in marketing centres would need a thorough overhauling, eliminating or reducing, as far as possible, the profits of the middleman. But this is of subsidiary and subsequent consideration.

To raise the average milk production of the village cow too essentials are required *viz* :—

1. Progressive policy of selective breeding followed by rigid castration of village scrub bulls.

2. Provision of sufficient food for village cattle in different seasons of the year.

No economic programme to improve the milk production in villages can work until success is achieved in these two directions. Work relating to these forms a part of cattle improvement schemes functioning in various provinces. But the results of these schemes have not yet borne fruit. It appears that a much larger measure of estate help is necessary to solve some of the basic problems affecting the economics of milk trade in villages. I may now directly proceed to bring forward the following outstanding points for consideration :—

1. Rigid castration of scrub, bulls to be made compulsory by Government.

2. Large Government breeding farms to be installed with the view first to produce (by suitable breeding methods) superior bulls before launching on an extensive programme of bull distribution in the villages.

3. Every Provincial Government to see that there is sufficient acreage under fodder crops, pastures, oil seeds and pulse crops, so as to provide enough of roughage and concentrate feeding to cattle. In some provinces like Sind (for instance) where there is little or no rain, this is possible only by legislation requiring every landholder to cultivate a certain percentage (say 3-5 per cent.) of his cultivable area under fodder crops, as distinct from cash crops. Forests need also to be tapped for increasing fodder and grazing. The position in Sind is that in year 1944-45 there were about 245,524 acres of land under fodder as against the total livestock population of 2,123,974 in that year. Detailed calculations show that this hardly provides 50 per cent. of the fodder requirement of cattle in Sind. It is clear therefore that the majority of cattle in the province do not get enough roughage to eat and to have their fill. The position of supply of concentrate feeds is by no means better. That this situation, to a less or more extent, is true of other provinces also, there is no doubt. We are at present facing rather difficult times. Competing factors seem to creep in when organising human and animal feed supplies. In the keenness of this competition we seem to forget that most animal feeds are converters to better and superior human feeds.

These are all tough problems but they are the key problems which have to be dealt with determinedly by the estate if the production of the village milk in India is to be brought on sound economic basis.

Dealing with the question of improvement of marketing of dairy produce, the only dairy produce that the village maldar can put to the market under the present conditions is ghee or clarified butter. The way to ensure satisfactory price to the producer is by co-operation Dairying. Estate has to help a great deal in initiating such a co-operative organisation. In order that the producer gets a fair return for his milk and the consumer gets a good quality product at reasonable price, milk production in rural areas and its disposal in various centres both as liquid milk and as ghee should advisably be controlled by Government agencies with the help of co-operative societies consisting of representatives of producers and consumers.

Government should have licensed milk and ghee depots located at suitable centres through which alone sale should be effected. Government should also establish with the help of co-operative societies an organisation whereby collection of milk and ghee is made and brought to assembling centres. Loans would have to be advanced by Government to the producers. Government subsidy will be necessary in the beginning to meet with the unpurified dairy trade.

Such an organisation, when set up on sound lines, will kill the much abused trade and with it will eliminate the unscrupulous middleman, thereby ensuring maximum return to the producer.

APPENDIX III (1)

(g) By Dr. L. C. Sikka Assistant Director of Agriculture (Liverstock) Bengal

1. *Economics of Village Milk production.*—The annual milk production of India has been estimated to approximate 62 million maunds. This gives a daily consumption of 6·6 ounces per head on average. It is now agreed that this is much below the desired rate of consumption, and that the existing production must be increased at least three times to meet the optimum milk requirements of the nation.

2. Nearly 57 million maunds of milk, or approximately 92 per cent. of our existing supply, is derived from rural areas. This total quantity, although very large is produced by thousands of small units of a few cows and/or buffaloes each. Outside the few specialised dairying tracts we have little organised milk production. A cultivator may keep a buffalo for his domestic milk and ghee supply ; but, more commonly, he keeps a cow or two to raise the plough bullocks he needs. Of course, these cows yield him some milk as well. Milk production, under such conditions, is incidental to crop production, the maintenance of cows occupying a position secondary to the upkeep of bullocks. Naturally this leads to only small scale production of milk, the production per unit seldom exceeding a few seers.

3. The remaining five million maunds of milk, or about 8 per cent. of the total supply, are produced by professional milkmen, in urban areas for local consumption. It is universally recognised that this milk is produced under the most unnatural conditions, and its production under such a system should give place to its supply from rural areas. The bulk of the rural milk is sold away in the form of milk products at present. The diversion of a part of such milk for consumption in liquid form elsewhere should thus cause no hardship, Rather, it should react to the advantage of the rural producer, who will thereby get a higher return for his produce.

4. The question naturally arises : Although milk is surplus in the rural areas, why is it that a major part (60 per cent.) of the urban requirements are produced within the urban areas themselves ? Milk is a bulky and perishable commodity. Its collection from many small scale rural producers, and its transport to urban centres of consumption, is not easy. But is that the only or even the most important reason for the present conditions ? Can the villager, under his present system of milk production, produce milk cheaper than the professional urban milk, producer ? Unfortunately, the economics of milk production has been studied but little. Very few results concerning milk costs are, therefore, available. In what follows, the author has tried to examine the question on the basis of the published data which he knows of.

5. The Department of Agriculture, Punjab, has been carrying out studies into the family budgets of selected tenant cultivators and peasant proprietors of that Province since 1932-33. The cost of production of milk in case of the milch animals kept by these cultivators has also been determined as a part of these studies. The results thereof for the years 1932-33 to 1938-39 have been published by the Board of Economic Enquiry, Punjab.* The relevant results regarding the cost of production of milk are reproduced from these publications in the Table below. The cost has also been studied in case of (1) certain professional milkmen (Gujars) of Lyallpur†, (2) the Punjab Agricultural College, Dairy Farm, Lyallpur†, and (3) certain

* Board of Economic Enquiry, Punjab, Publication Nos. 40, 44, 50, 59, 62, 67 ,72.
† Board of Economic Enquiry, Punjab, Publication No. 55.

Military Dairy Farms of Punjab‡. The results of these studies are also presented below for comparison with the date for the rural milk :—

Serial No	Particulars of milk producer.	Kind of milch animal.	Year.	Number of milch animals.	Per animal.		Cost of production of milk per maund.
					Net cost of upkeep.	Milk produced.	
					Rs.	Mds.	Rs.
1	Tenant Cultivators (Lyallpur).	Buffalos ..	1933-34	13·00	62·22	25·68	2·42
			1934-35	9·00	62·83	23·15	2·71
			1935-36	9·09	58·56	30·14	1·94
			1936-37	9·98	65·56	24·65	2·55
			1937-38	12·42	62·78	24·05	2·53
			1938-39	9·33	51·31	22·46	2·28
		Cows ..	1933-34	6·00	38·59	10·42	3·70
			1934-35	5·00	41·41	16·00	2·59
			1935-36	5·46	37·07	16·39	2·26
			1936-37	4·49	46·04	15·06	3·03
			1937-38	6·49	26·82	17·61	1·52
			1938-39	6·38	33·10	13·24	2·50
		Mixed Cows and Buffalos.	1932-33	12·40	44·59	18·40	2·42
			1933-34	19·00	54·76	20·86	2·63
			1934-35	14·00	55·18	18·02	2·68
2	Peasant Proprietor (Jullunder, Hoshiarpur, Amritsar and Rohtak).	Buffalos ..	1937-38	3·58	89·14	37·51	2·38
			1938-39	3·96	86·61	22·26	3·76
		Cows ..	1937-38	1·21	13·04	7·02	1·99
			1938-39	1·71	62·71	13·09	4·79
3	Professional milkmen in Lyallpur City.	Cows ..	1932-33	25·62	124·51	39·82	3·12
			1933-34	27·57	127·42	39·95	3·19
			1934-35	22·16	102·89	39·74	2·59
4	Punjab Agricultural College Dairy, Lyallpur.	Cows ..	1931-32	23·68	262·20	57·06	4·62
			1932-33	21·68	258·10	50·87	5·00
			1933-34	25·46	258·48	67·00	3·88
			1934-35	24·95	262·40	73·62	3·56
5	Military Dairy Farms (Punjab).	Sindhi Cows ..	1932	84	..	37·20	4·02
		Ordinary Sahiwal Cows.	1932	179	..	40·34	3·92
		Ferozepur Sahiwal Cows.	1932	51	..	73·17	3·06
		Half-bred European Cows.	1932	213	..	73·17	2·77
		Murrah Buffalos	1933	294	..	37·80	4·7

‡ Report on the Marketing of Milk in India and Burma, 1941, page 112

6. It will be observed that the cost of production of milk varies with (1) the year of study, (2) the milk yield per animal; and (3) the system of milk production. The studies concerning the urban, rural and dairy farm produced milk relate to different periods, although the years 1932-35 are common to them all. Since the price of feed, wages of labour and other items of cost varied more or less from year to year during the period covered by the various studies, a comparison of the costs under the different systems is valid on the basis of the costs for the latter period only, provided, of course, these costs are otherwise comparable. Unfortunately, however, this important proviso is not satisfied by the costs of the rural and the Military Farm milk. This is because, firstly, both these sets of cost are incomplete : The former lack the costs on account of labour and housing from the debit side and the cost of manure from the credit side ; while the latter are even more incomplete, since these include only the cost of feed, the cost of labour exclusive of supervision, and the cost on account of depreciation of livestock. Secondly, in the case of rural milk, although separate costs for cows' and buffaloe's milk have been given, the method followed in determining these costs is not strictly accurate. Each cultivator fed roughages to his cattle consisting of buffalos, cows, bullocks and young stock from a common lot. Separate records of consumption by individual animals were not maintained. The share of each animal was determined by dividing the total cost by the number. of adult animals, the consumption per cow being taken, equal to that by a buffalo, which is wrong. This must have had the effect of lowering the cost in case of buffalo's milk at the expense of the cost of cow's milk.

For want of the requisite data, it is not possible to allow precisely for the first omission mentioned above. But for the rural milk that may be done approximately on the basis of Gujar's milk, where the cost of labour plus the cost of housing minus the cost of manure constituted nearly 20 per cent. of the total cost of production of milk. As for the second point, the position is even more difficult. It is felt, however, that since the existing separate results have no real basis, it will be better to lump the two sets of data for cows and buffaloes and thus calculate the cost of mixed milk. That has been done, and the costs for the 3 years 1932-35 thus obtained have been, shown in the foregoing table.

7. The costs of mixed milk, when increased by 20 per cent. come to Rs. 2·90, Rs. 3·16 and Rs. 3·22 per maund for the years 1932-33, 1933-34 and 1934-35, respectively, as against Rs. 3·12, Rs. 3·19 and Rs. 2·59, respectively, in case of the cow's milk produced by Gujars and Rs. 5·00, Rs. 3·88 and Rs. 3·56, respectively, for the cow's milk produced at the College Dairy, Lyallpur. The cost of the dairy milk is, no doubt the highest in each case, although it considerably decreased as the milk yield improved during the period. An important reason for this comparatively higher cost is the higher cost of buildings and equipment in this case, which, of course, made the production of a better-cleaner, milk possible. But it will be seen that the cost of Gujar's milk approximately equalled the cost of rural milk during 1933-34, it was slightly higher than that in 1932-33, and was considerably lower during 1934-35. Of course, the Gujars produced milk at the place of its consumption. But this was not so in case of the cultivators. When the cost of transport of rural milk to an urban consuming centre is also taken into account, the difference in favour of the Gujars becomes all the more striking.

8. No doubt the foregoing results are based on too limited a data to be generalised from. But they are very interesting in as much as they tend to show how the urban professional milkman *in spite of his obvious handicaps, managed to produce* milk nearly as cheap, if not cheaper, as the rural producer. In view of these results the need for detailed studies into the cost of production of milk under different systems and conditions is too obvious to need emphasis. The production of more

milk is no doubt a national requirement. But it is important to remember that the production of the extra quantity required can not be fostered by the promise of higher prices, as even the present price of milk is admitedly too high for the poorer section of the community. If increased consumption of milk by the present non-consuming section is the aim, the increased quantity required must be produced (and sold) at a lower rate(s) than at present. But how that may be achieved can best be shown by large scale studies, under different conditions into the economics of milk production.

9. *Improving the marketing of dairy produce.*—As previously stated, there are two types of producers in the Indian dairy trade : the urban and the rural. Since milk production in urban areas is an unhealthy practice, which must be given up, only the improvement of marketing of rural dairy produce need to be considered.

10. The present system of marketing of rural dairy produce leaves much to be desired. Under this system, the village producer is more or less completely at the mercy of middlemen. Consequently, he is much exploited in every possible way. Neither his produce is always sold in the best market, nor he gets a fair share of the value of that produce. He finds, therefore, milk production not very remunerative, and neglects it. This is leading to a gradual degeneration of his milch animals making the work of cattle improvement an uphill task. The improvement of marketing of milk is, thus, an essential pe-requisite to the work of improving village dairy cattle.

11. The ideal method of marketing of village dairy produce will be through a producers' co-operative organisation running its own co-operative dairy factories in villages and depots in urban areas. The producers can then be sure to get full value for their produce. The success of such a scheme must, however, rest upon (1) the presence of true co-operative spirit amongst the constituent members of the organisation, and (2) the existence of effective control on the quality of milk and milk products affording due protection to the honest producer from the dishonest dealer. Unfortunately, co-operative enterprises have failed to flourish in this country in the past. This has been because of the want of both the pre-requisites mentioned above. However, the lack of success in the past should not deter us from making further trials in that direction under more favourable conditions in future.

12. Pending the development of co-operative organisations for the marketing of rural dairy produce, the prevailing chaotic condition should be rationalised by enforcing a system under which there is (1) the complete control of production, collection, processing, manufacture and distribution of milk and milk products in order to control their quality, milk production in urban areas being banned, (2) the sale of milk and milk products of standard qualities, and (3) the statutory control of prices of milk and various milk products for producers and consumers.

In order to enforce the foregoing system, a milk Council representative of all sections—production, processing, distribution, manufacture and consumption—of the industry, and the nominees of the Government (Public Health and Agriculture Departments) should be set up in each province. On account of the vastness of each province, the Council will have to restrict its activities in the beginning to a small selected area and gradually extend these to other parts of the province. The Council should be invested with statutory authority over all sections of the industry in areas which are brought under its control at the outset or from time to time later on. No one should be allowed to carry out milk business—production, collection, processing, manufacture or distributing—in such schedule areas without a license from the Council, which will maintain registers of licensees of different categories. The Council should have a Producers' and a Distributors' (including Manufacturers') Sub-Committee to look after the production and distribution sides of the industry, respectively. It

should carry out its functions through the agencies of these Sub-Committees. The Council should allocate quantities for the liquid milk market and for the manufacture of different milk products, and should fix prices of milk and milk products of different grades. It should zone distributors both with respect to their purchases and sales. It should have power to impose fines on licensees for breaches of any of the conditions to which they may be subject, and, where necessary, to revoke licenses. The Council, through its Producers' and Distributors' Sub-Committees, should also foster production of more and better milk by cultivators, and arrange the proper disposal of existing and prospective supplies. There appears to be considerable scope for improvement in these directions by licensing both the producers and distributors, and by arranging supply of facile credit, cattle feed, breeding bulls and milch animals to producers, and processing machinery and equipment and suitable transport service to the distributors. The distribution of milk should be in the hands of a few responsible agencies, which should be licensed and zoned. Such agencies should establish depots and sub-depots in the area of their operation and be responsible for the quality of produce offered for sale and the condition of premises. A large-scale producer should also be permited to distribute milk at the scheduled rate, and should be zoned for this purpose. Hawking of loose milk should be forbidden, deliveries to consumers, when made, being restricted to milk in bottles or in cans by the licensed agencies. It should be an important duty of the Council to conrtol the manufacture of milk-products. The aim should be to dispose of milk in such a manner as will give maximum return to the producers and prevent waste.

The control of quality of milk and milk products should be the duty of the provincial dairy development staff. This staff should inspect and license premises for milk production and factories for processing and manufactures, take and test samples of milk and milk products and should serve as the extension service of the dairy industry. The Public Health Department should still continue to administer the Pure Food Act, under which adulteration of milk and milk products is punishable by a Court of Law. The extra agency now recommended is considered necessary in order to exercise a more thorough and immediate check on quality. The control of quality under the existing system is very dilatory, and therefore, ineffective. The proposed dairy staff should be able to take prompt action by cancelling the license of an undesirable person.

13. *Recommendations.*—

(*i*) The cost of production of milk should be studied under different conditions and systems of producing milk.

(*ii*) There is need for a wholesale reorientation of the existing system of marketing of dairy produce. This system must give place to a policy under which the primary producer is assured a fair share of the value of his produce, which is generally not so at present.

(*iii*) The production of milk and milk products should be restricted to rural areas, the existing system of milk production in urban areas being progressively banned.

(*iv*) The ideal system of marketing rural, dairy produce under Indian conditions is through Producers' Co-operative organisations running their own rural dairy factories, and urban depots. The establishment of such organisations should be taken up where conditions essential for their success are obtainable.

(*v*) Our future system of the marketing of milk and milk-products should have as its basis (1) the complete control of the production, collection, processing, manufacture and distribution of milk and milk products by a system of licensing of

producers, and licensing and zoning of distributors, the distributors being limited to a few responsible and efficient agencies, (2) the sale of milk and milk products of standard qualities, and (3) the statutory control of prices of milk and various milk products for producers and consumers.

(*vi*) A Milk Council should be set up in each province to implement the foregoing policy. This Council should consist of representatives of all sections of the industry and Government nominees of the Public Health and Agriculture Departments. It should operate through its Producers' and Distributors' Sub-Committees, and should be invested with statutory authority over all sections of the industry in the area brought under its control. Until the trade is properly organised, the cost of the Council should be met by the Government. Thereafter, the industry should bear its cost.

(*vii*) The quality of milk and milk products should be controlled by a system of inspection and licensing of premises for milk production and factories for processing and manufactures. The issuing of such licenses should be the duty of the Provincial Dairy Development staff, who should be empowered to revoke them in the event of the quality of milk and milk products produced being unsatisfactory. Of course, this system should supplement and not replace the existing legislation which has the same object.

APPENDIX III (1)

(b) By Sri Rao Sahib M. S. PALANIAPPA MUDALIAR, B.A., Honorary Secretary Coimbatore Co-operative Milk Supply Union.

Against the back-ground of centuries of village life in India, the twentieth century tarted with numerous towns and cities and milk and its products today have become marketable commodity. Prior to this, there was no production in the village, except or the consumption in the village itself. Even in the village it was a commodity, when a surplus not to be sold, but to be given free by the producer to his neighbours.

These age long conditions still rule milk production in the villages far off from ny town or city, except for the fact that all resources of the villager to produce urplus milk has been lost on account of the several usual impediments in rearing cattle n these days. The marketable milk is now produced only in villages which are nearer o urban areas and connected to them by passable and reachable routes. There are, f course, even now distant places, where milk and its products are produced in surlus. These milk pockets continue to be such, because these areas are sparsely opulated and because, the land is not suited for intensive cultivation but left mostly as pasture land.

Only during the past decade, the authorities have tried to a very small extent to et right matters in the dairy trade, as they found that in urban areas, the shortage of airy produce was felt. On the other hand, demand and supply of milk for the vilages are somehow adjusted either by being satisfied with the quantity available or hen it is in a surplus by manufacturing and selling away the butter or ghee. Hence o one worried about the villagers and their dairy trade, except in conjunction with the equirements of urban areas. The increasing demand of urban areas have put a tress on dairy production, in the neighbouring villages and the several factors ruling his have not yet been properly adjusted. They are :—

1. Land
2. Labour
3. Milch cattle
4. Feed
5. Other conditions, such as seasons, climate, etc.

Except the 5th item, all other items are adjustable by man and unless a thoughtout plan is brought into being, the dairy industry of the villages will have to wade through as at present and it will not till then be able to meet the entire demands of the country for milk and its products.

The first attempts at planning in our country are the starting of co-operative institutions to handle this problem. These institutions have been just started on their work and are undergoing the early training by overcoming the initial difficulties in their administrative working, not concentrating on the developments of milk production. For the successful working of these institutions, the controlling of production of milk and its products is quite essential. The conflicting interests that are to be reconciled in dairy industry are that of the producer, the consumer and the staff that are employed in the industry. This third interest of the staff is a necessary evil in marketing of village milk in the urban areas.

At present, the price of milk is controlled mainly by the selling price agreeable to the consumer and it is not cotrolled by the cost of producton of milk to the villager The starting of Co-operative Milk Societies has to a certain extent secured for the producer his price for milk. But it has not yet assured him a market for it all through the year. This is the present position of the trade and none has interested so far in this affair. The unsold milk is converted into by-products such as butter, ghee, etc and sold at less than half the price for milk. This is going on for ever and ever and here seems to be no end to this uneconomic nature of the dairy portion of the villager's occupation. He does not know how to overcome the difficulty of not being able to sell his milk as whole milk during the surplus season. He does not know how to equalise production, but goes on producing less milk when more milk can be sold or marketed and producing more milk when only small quantities are needed by the consumers.

These facts go to prove the necessity of strong and intelligent organisations being formed through the country to stand between the village production and city consumption. These organisations must be such as not only to meet all the just demands of the consumers and producers but act with foresight and go on organising and educating the producer to produce just that quantity of milk that can find use by the consumers. They should also interest themselves in breeding of milch cattle and in controlling of the calving seasons, apart from finding markets for such of the milk products as butter, cream, during the unavoidable surplus season. No villager knows now the cost of production of his milk, which is dependant on several factors. These institutions must devote their attention to this and get for the villager his cost of production for milk.

The organisation of institutions on co-operative basis to handle this problem is the only feasible solution. A Co-operative Milk Society does know how to reconcile the interests of the producers, consumers and workers, because, they will have the guidance of the Animal Husbandry, Co-operative and the Dairy Departments. They can have in the management of the Society the representatives of all these three interests.

The organisations of such Co-operative institutions must follow and not precede a thorough enquiry and survey of entire areas to find out the demand and supply of dairy produce in the areas and their suitability to increase production. This milk survey must be conducted on a country wide basis with an eye on the future requirements of the consuming public. After this survey, Co-operative Societies, suitable to the area must be started and must be supervised and developed by the Departments of Animal Husbandry, Dairying, and Co-operation. The representatives of these departments

can be included in the management of these institutions. The representative of the Animal Husbandry will advise the management on improving and increasing milch cattle, that of Dairying on the handling, marketing and hygiene of the available milk and that of the Co-operative on the maintenance of accounts.

Every urban area must have one Milk Society to look after its needs. Big cities must have a federal type of society, having affiliated to it all the milk producing societies. To give an idea of actual working, I give below in short the constitution and working of the Coimbatore Co-operative Milk Supply Union.

The Coimbatore Co-operative Milk Supply Union is a Co-operative Society with about 25 milk Supply Societies affiliated to it and 25 individual members, drawn from the elite of Coimbatore City. It has a Board of Management and an Executive Committee with a majority of representatives of milk societies. The Health Officer of the Coimbatore Municipality is an ex-officio director. Its area of operations is six taluks out of the ten taluks in the Coimbatore District. The Head Office at Coimbatore collects sufficient milk from the neighbouring 15 milk societies and that is being marketed in the Coimbatore City. The other Milk Societies in the smaller urban areas such as Dharapuram, Tiruppur, Mettupalayam, Pollachi and Udamalpet are collecting milk from the producers and selling directly to the consumers. The Union is expected only to give advise and supervision. It is handling daily about 10,000 pounds at Coimbatore and about 1,000 pounds each in the other urban areas apart from supplying 3,500 pounds of milk and 150 pounds of cream to Military Farms Department. There is an affiliated society at Senjeri, specially devoting its attention for improving the milk yield of the local buffalo by adopting improved breeding methods. The Union has proposed to start and work a creamery at Dharapuram. The total number of customers who get milk in their houses will be about 3,000. Most of the Government and semi-Government institutions are purchasing their requirements only from the Union.

The above information in concise will give an idea of what a co-ordinated effort can do within 10 years provided the institution gets not only the support of the producers and consumers but also of all the officials of the department. We are of opinion that all cities must have such institutions as above to tackle milk problem. When we solve this problem for the city we indirectly solve that of the economics of village production.

APPENDIX VI (2)

CREAMERY AND FACTORY SYSTEM OF DAIRYING AS A MEANS FOR ACCELERATING THE DEVELOPMENT OF THE CATTLE AND MILK INDUSTRY IN RURAL AREAS WHERE IMPORTANT BREEDS OF CATTLE ARE ESTABLISHED.

(*a*) By K. P. R. Kartha, Registrar, Central Herd Books, Indian Council of Agricultural Research.

A more apt introduction to this note cannot be thought of than an oft repeated statement by Sir Arther Olver that cattle improvement in India should begin at the marketing end. By this statement he meant not any elaborate advertising campaign praising the virtues of milk and milk products and advocating their wide use, but the establishment of an efficient marketing organisation which will enable the breeder to obtain an economic return for his produce. The assurance of an " economic return " is the crux of the whole problem of cattle improvement in India. Indian

cattle are not intrinsically as bad as they appear to be. Indeed they have been shown to possess undoubted potentialities for production which remain undeveloped under the present conditions of neglect in which they live. It has been found that better feeding and management alone can produce an immediate increase in milk production of at least 50%, and further increase can be obtained by systematic scientific breeding. And there is an unlimited market in the country which can absorb any expansion in production. Cattle breeding, however, is in the hands of poor and resourceless farmers, who, in the existing conditions, are unable to take full advantage of the market and often get a price which is below their cost of production. This kills all their initiative and enthusiasm, the result being gross neglect of their cattle. The first step to be taken, therefore, is to generate the breeder's enthusiasm and to enlist their active co-operation by making the business of cattle breeding financially attractive to them.

The annual production of milk in India is estimated to be about 601 million maunds. About half this quantity is estimated to be marketed in the form of ghee. This figure relates to the whole country. Breeding areas are in the interior villages far removed from the centres of consumption. Almost the entire marketable surplus of milk from these areas is disposed of in the form of ghee. The estimated annual production of ghee in India is about 14 million maunds, of which 4·2 million is used up in domestic consumption and the remaining 9·8 million is sold off the holdings. Assuming that on an average one cow or buffalo produces roughly half a maund of ghee per year a rough calculation indicates that at least 30 million cows and buffaloes are used in the production of ghee.

It may be interesting to examine the conditions which debar these animals from making an adequate return to the owner. The average cattle breeder in India is probably the poorest peasant in the world and is absolutely without resources. He lives on small holdings and owns two or three cows and/or buffaloes, as against 27 or 28 animals maintained by a breeder in advanced countries like England. The small quantities of milk which are left over after domestic consumption, are converted into curd, from which butter is churned out. The butter is sold off generally as ghee or in rare cases as butter. This ghee is generally collected by village merchants or itinerant ghee collectors who are agents of big merchants in cities. An agent with small means collects small quantities and gives to another who is in a position to invest more for handling larger quantities. These intermediaries vary in number and status from place to place. Through these the ghee arrives in the nearest mandi. If the mandi is a small one the merchant in the mandi may send it to a larger mandi where it is purchased and distributed to various centres of consumption. There is thus a long chain of middlemen between the producer and the consumer and each naturally has to make a profit. It not unoften happens that the big merchants with resources at their command advance money to the breeders, who are usually impecunious and are in need of loans on any terms. He enters into a contract to return the amount with interest in the form of ghee in the following or a future season. The merchant of course wants the ghee to be sold to him at a price lower than the market rate.

It is not possible to say with any degree of accuracy what proportion of the price paid by the consumer is received by the producer. In a few cases where investigations have been made the proportion is found to vary between 51 and 92% of the consumer's price, the percentage depending on various conditions and circumstances. A fair average for the country would appear to be between 60 and 70%, or say two-thirds of the price paid by consumer. Thus when ghee sells at Rs. 2 per lb. retail (which is roughly the present market rate) the consumer gets Re. 1-5-4. On an average 20 lb. of milk will be required to produce a lb. of ghee. The producer therefore gets roughly one anna per lb. of milk, plus the buttermilk left over after churning the curd.

This return may be examined against his cost of production. This is a very difficult figure to calculate as various factors enter into the computation. When adequately fed an average cow yielding 12 lb. of milk will require about 40 lb. green fodder, 6 lb. dry fodder and 6 lb. concentrates a day, which at present market rates cost about Re. 1-9-0. The feed cost of milk is thus 2 annas per lb. It is the general experience that feed cost is about half the overall cost of production, which therefore comes to 4 annas. An article produced at a cost of 4 annas is sold at one anna. The calculation may be made in a different manner. A cow weighin g 1,000 lb. and yielding 12 lb. of milk requires daily a total of 9 lb. Starch Equivalents in the feed. At 3 annas per lb. Starch Equivalent, which is the current market rate, the feed cost of production comes practically to the same amount.

As the producer gets the butter milk free as also a calf, the disparity between the cost of production and sale price will not in practice be as wide as 4 : 1, but still it is considerable and makes cattle more a liability than an asset to the breeder. This low return leads him to neglect his animals. The neglect leads to their deterioration which results in the lowering of production and raising of cost of production. It is a matter of common knowledge that whenever a market exists the cattle are better fed and cared for and are in good condition. But markets, in the sense that the producer is able to take full advantage of them, are rare. With better feeding production rises, and it is the universal experience that when the same cow is made to yield more milk the cost of production per lb. of milk decreases due to the maintenance cost being distributed over the larger production.

Various methods of propaganda are adopted in the different provinces to induce the villager to look after his animals better. Lectures illustrated by magic lantern slides are delivered by departmental staff emphasising the advantages of better feeding and management, use of better bulls and so on, posters are exhibited, demonstration farms are run, bulls are distributed, cattle shows are held and prizes are given. But these do not cut much ice. Their effect is almost imperceptible. The propaganda falls flat, as it should be, when the person to whom it is addressed knows what he gets for the trouble taken. It is not realised yet that nothing can be a more effective propaganda than helping the breeder to secure a price which makes his venture financially attractive. As shown above he is resourceless and poor. The size of his herd is too small to form an economic unit. He is heavily indebted (probably not now) and is keeping himself afloat under a complicated system of credits and advances in which he is always the loser.

The need for an efficient marketing organisation which will eliminat the long chain of intermediaries between the producer and the consumer is self-evident. An independant Co-operative Society of Producers will be an ideal organisation, but under present conditions described above no voluntary organisation can be expected to be formed. Government should take the initiative, establish the organisation, demonstrate its success and then hand it over to the producers when they are found fit to run them. To begin with they should be in the form of milk collecting centres in breeding tracts with creameries for handling the milk. The organisation set up should relieve the producers of all worries about marketing, dispose of the milk to their best advantage and secure for them as large a fraction of the price paid by consumer as possible.

These Milk Collecting Centres should be established in the heart of the breeding tracts of India. Figures of production of ghee will be a proper guide in the actual selection of the localities. A statement showing important ghee producing areas of India is appended. Information therein may be used in choosing the centres. Districts of Karachi, Hyderabad and Tharparkar in Sind, Canal Colonies and Hariana

Tract in the Punjab, Gujerat Division in Bombay, and Ongole Tract and Coimbatore District in Madras are important cattle breeding areas where well-known breeds are maintained and from where breeding stock are supplied to other parts of the country. These are the areas where a start could be made with the establishment of milk collecting centres.

Although at present all these areas are producing ghee it is not essential that all the milk produced should be converted into ghee. Where it is possible the milk can be marketed as cream or fresh butter which fetches better price. The manufacture of evaporated milk or milk powder, large quantities of which are now imported from other countries may be taken up whenever practicable. There are backward areas in the country where cattle cannot thrive and where this portable form of milk will be of very great benefit. By far the largest proportion of milk will have to be converted into ghee, and any creamery set up should have equipments for the manufacture of skim milk powder. That will add to the income of the producer. Large quantities of skim milk powder are imported into this country, and a calculation made some years back before the war showed that reconstituted skim milk out of imported powder cost more than the price at which fresh milk could be had in certain milk districts of India. As is done in England under the milk marketing scheme the entire sale proceeds, in whatever form the milk is marketed, should be pooled and each breeder should be given a price proportionate to the quantity of milk supplied by him.

Simultaneously with the establishment of the creamery organisation and as an integral part of it Feed Depots should be established. Cattle feeds should be purchased at wholesale prices, stocked in these depots and retailed to the members at cost price, the price being deducted from the payment for milk.

When the creamery organisation is in full working order measures for cattle improvement may be introduced. The breeder by reason of the enhanced income is then in a receptive frame of mind and will willingly accept and follow all the advice that is tendered to him. The Demonstration Farms and the magic lantern lectures will then have some meaning for him.

The first step to be taken is to ensure that feeding is adequate in quantity and balanced in quality. This alone has been found to result in an immediate increase in milk production of about 50% in the half starved village animals. That increase will add substantially to the breeder's income and at the same time reduce his cost of production. The organization should have on its staff competent men who can supervise feeding and give sound advice on all matters connected with feeding.

The second step should be to make arrangements for a regular supply of fodder. Fodders can be co-operatively cultivated. Advice should be given regarding silage and hay making, improvement of grass lands, rotational grazing and cognate matters.

The third step should be control of breeding. There should be no bull at the centre than that approved by the breeding expert of the organisation. The bulls should be incharge of paid keepers who will feed and maintain the bulls in proper condition. All the cows in the scheme and their progeny should be tattooed or branded for identification and every service should be recorded. Milk also should be regularly recorded. In short each unit should work as though it were a cattle breeding farm and detailed records should be maintained of all the operations in the unit.

Once the breeding control is started breeders should be told that only those who abide by the rules will be allowed to remain in the Scheme. By that time they will have realised that all this work is to their advanatage.

The Scheme should have arrangements in it for marketing not only milk but also of surplus animals. That will again add to the income of the breeders. Bulls with

records of pedigree and production behind them should fecth a much higher price than ordinary bulls of unknown parentage. Arrangements should be made by a central body like the Indian Council of Agricultural Research for the co-ordination of the work of these units in different parts of the country, for the full utilisation of the records, for the registration of the animals in the Herd Books for the collection, collation and dissemination of information relating to the operation of these units and the progress achieved particularly in regard to cattle improvement.

A unit like this will cost only a fraction of the money required for establishing a cattle breeding farm, but will be many times more effective. It will help in multiplying the production of breeding bulls, for which there is an urgent necessity. The bulls produced from such a scheme will be superior in the sense that they will be progeny tested on a much wider basis than possible in a Government farm and also in the sense that they are evolved in environments in which they are to work.

If properly developed a creamery organisation of this nature can prevent or at least reduce the flow of first class cows and buffaloes to large cities, from which they seldom return. It is well known that the city trade is a serious drain on the cattle wealth of India. A creamery organisation can do much in carrying milk to the cities instead of the animals. If transportation of liquid milk is not possible immediately a substantial portion of the city requirements can be met by evaporated or dried milk, and the drain of animls from breeding areas to cities may be reduced to the extent to which such a replacement is possible.

The popular Governments now in power in all provinces of India have often emphasized the necessity for rural developments, the organisation of producer Societies and the elimination of middlemen in the marketing of their products. The creamery organisation described above is an excellent way in which policy may be implemented.

Before concluding this note it is necessary to emphasise that what is envisaged here is the establishment of a creamery organisation in *Breeding Areas* fully equipped and staffed for dealing with all matters connected with cattle improvement in India. It should arrange for the disposal of animals and animal products to the best advantage of the producer, for the supply of feeds, for cultivation and preservation of fodder for the control of breeding, for recording and utilisation of records and for the distribution in a systematic manner of the tested bulls which are surplus to the requirement of the unit. Negatively it may be pointed out that it is *not* a cooperative Union similar to that working in Lucknow or Madras that is in view. In such a Union the breeder does not come into the picture at all. It helps a few producers of milk who buy cattle from breeding areas and bring them to the milk collecting centres. The absuses of the city trade are repeated in them in a less aggravated form. Such Unions are capable of being improved and of being used to a certain extent for purposes on cattle improvement. But the real organisation should be located in the breeding area, from which the animals should not move but only their products.

RECOMMENDATIONS.

In order to enable the cattle breeder in India to adopt scientific methods of feeding, breeding and management, which alone will develop the undoubted potentialities for milk production possessed by Indian cattle it is essential that Government should set up a net work of marketing organisations in important *breeding tracts*. The organisations should be as under :—

(*a*) Each organisation should consist of a number of milk collecting stations with a creamery at the centre for handling, processing and manufacture of

(*b*) The organisation should dispose of milk to the best advantage of the producer and secure for him as large a fraction of the consumer's price as possible. As to how the milk should be disposed of, whether as ghee, butter, cream, dried or evaporated milk, will depend upon local conditions and circumstances. In any case arrangements should be available for disposing of separated milk economically.

(*c*) The organisation should have feed depots for stocking and distribution of feeds at cost price. It should have competent staff for advice and assistance regarding all aspects of feeding including the cultivation and preservation of fodder as silage or hay, improvement of grassland, grazing and so on.

(*d*) The organisation should have arrangements for full contic lover breeding, for recording of pedigrees and performances, for marking the animals for identification, for utilisation of records, for distribution of surplus stock and so on.

(*e*) In short each centre should be fully equipped and staffed as though it were a Cattle Breeding Farming.

APPENDIX.

Important ghee producing areas and assembing and distribution markets (showing production, arrivals and stocks) in India.

1 Producing Areas.	2 Annual Ghee Production. (Thousand mds.).	3 Important markets where ghee is sold.	4 Annual Ghee Arrivals. (Thousand mds.).
		(CENTRAL PROVINCES.)	
Akola District	38	Akola	4·0
		Karanja	3·0
		Mangrulpir	4·0
Amraoti District	28	Paratwara	10·0
Chindwara District	35	Chindwara	3·0
Hoshangabad District	37	Gadarwara	3·0
		Itarsi	5·0
		Kareli	3·0
Saugor District	47	Saguor	15·0
Yeotmal District	42	Yeotmal	7·0
		(BENGAL).	
Dacca District	33	Dacca	10·0
		Calcutta	600·0
Bardwan District	28	Burdwan	9·6
Jalpaiguri District	6	Jalpaiguri	63·0
Mymensingh District	62	Mymensingh	2·6
		(ORISSA).	
Anugul Area	2	Anugul	1·5
Behrampur Area ..	2	Behrampur	1·0

APPENDIX—*contd.*

1	2	3	4
Banki Area	2	Banki	11·5
Nawapara Area	1	Nawapara	0·5
Parlakemidi Area	2	Parlakamidi	1·0
Rayagadha Area	1	Rayagadha	0·6
		(BIHAR).	
Patna Division	190	Arrah	5·0
		Gaya	10·0
		Patna	15·0
Bhagalpur Division	253	Begusarai	7·0
		Biharganj	5·0
		Khagaria	20·0
		Murliganj	5·0
		Nirmali	5·0
Tirhut Division	316	Bairagnia	15·0
		Chhupra	20·0
		Darbhanga	25·0
		Janakpur Road	7·5
		Kamtaul	5·0
		Motihari	5·0
		Muzaffarpur	20·0
		Revalganj	10·0
		Sitamarhi	5·0
		PATIALA STATE.	
Narnaul District	10	Narnaul	12.0
		(NIZAM'S DOMINIONS).	
Aurangabad District	24	Jalna	1·5
Bidar District	54	Bhalki	1·5
		Ridar	10·0
		Udgir	7·0
Nalgonda District	21	Jangaon	2·0
Nander District	42	Nander	1·3
		Unri	1·2
Nizamabad District	6	Nizamabad	2·0
Osmanabad District	27	Latur	2·5
		(PUNJAB).	
Canal Colonies .. .. .. (Lyallpur, Montgomery, Shahpur and Jhang Districts).	526	Bhalwal	3·0
		Lyallpur	2·0
		Phullerwan	2·0
		Sargodha	3·0
		Tandlianwala	1·0
Hariana Tract .. .. .. (Rohtak, Hissar, Gurgaon, and Karnal District.).	303	Bhiwani	10
		Kaithal	20
		Uklana	30
Gujranwala and Gujrat District	194	Lalamusa	7·5
		Mandi Bahauddin	5.0
		Pindi Bhatrain	12·0

APPENDIX—*contd.*

1	2	3	4
	(AJMER-MERWARA).		
Ajmer-Merwara	47	Ajmer	20
		Merwar	11
	(MADRAS).		
Guntur Area	110	Guntur	90·0
Coimbatore Area	20	Coimbatore	15·0
Tirupur Area	15	Tirupur	11·0
		Avanashi	11·0
Sivakasi Area	3	Sivakasi	2·5
Karup Area	12	Karpur	9·0
		Trichinopoly	9·0
Ongole Area	10	Ongole	7·5
Prodattur Area	4	Pradattur	3·0
Salem Area	5	Salem	4·0
	(GWALIOR).		
Bhind	85	Bhind	13·0
Guna	56	Guna	7·0
Morena	107	Morena	16·5
Shivpur	62	Shivpur	6·0
Ujjain	55	Ujjain	15·0
	(SIND).		
Hyderabad District	88	Hyderabad	24·2
Karachi District	113	Karachi	41·5
Sukkur District	30	Sukkur	10·9
Tharparkar District ..	122	Mirpurkhas	6·2
Upper Sind Frontier District ..	22	Shikarpur	13·5
Amreli District	18	Dhar	2·5
Division.		Baroda	10·0
Baroda District	50	Petlad	3·5
Mehsana District	141	Chinoj	7·5
		Kherau	1·5
		Taranga	2·5
		Vadnagar	5·0
		Visnagar	5·0
	(UNITED PROVINCES).		
Central Zone	459	Ballia	20·0
		Bareilly	20·0
		Brijmanganj	25·0
		Nautana	15·0
		Nopalganj	7·0

APPENDIX—*concld.*

1	2	3	4
		(UNITED PROVINCES—*contd.*)	
	89	Ramnagar	3·5
Northern Zone			15·0
	258	Lalitpur	7·0
Southern Zone		Maueanibur	35·0
	895	Aligarh	15·0
		Auraya	20·0
Western Zone		Cawnpore	30·0
		Chandausi	12·0
		Etah	40·0
		Etawah	6·0
		Hapur	35·0
		Hathras	20·0
		Kasganj	100·0
		Khurja	7·0
		Shamli	40·0
		Shikohabad	30·0
		Sirasaganj	
		(ASSAM)	
	0·3	Dhubri	0·2
Ajmeriganj			2·8
	1·1	Blashbari	0·3
Bardwar			0·3
	0·4	Dibrugarh	0·4
Dordubi			0·2
	2·3	Golaghat	0·4
Hahim			
	0·5	Mangaldai	
Kharupétia			
	0·3	Bonigaigaon	
Sunamganj			
	0·4	Tijpur	
Udalguri			
		(MYSORE)	
	23	Anekal	0·5
		Bevanamalli	0·5
Bangalore District		Nelamgala	0·5
			1·4
	23	Davangere	3·5
Chitaldonij District			1·1
	14	Holenaripur	2·6
Hassan District		Basraul	
		Nagamangala and K. R. Pet.	2·1
		Maddur	2·3
		Mandya	1·1
Mysore District	17	Narasipur	
		(BOMBAY)	
	152	Basik-Deoli	7·6
		Poona	29·3
Deccan Division		Ahmednagar	3·0
	246	Ahmedabad	21·9
		Baroach	12·0
Gujrat Division		Nadiad	3·0
		Surat	18·0
	87	Hubli	2·5
		Belgaum	2·0
Karnatik Division		Sholapur	9·7
	26	Bombay and S. D.	114·7
Konkon Division			

APPENDIX III (2)

(*b*) W. P. FOSTER, ESQ., SUPERINTENDENT, POLSON MODEL DAIRY, ANAND (GUJARAT).

Introductory.—The following notes deal first in a condensed form with the advantages accruing to dairy farmers overseas from the creamery or factory system ; and secondly try to show, briefly, how this system can be applied to Indian Dairying as it exists today. The writer has special knowledge of conditions in Gujarat, Bombay Presidency, an area of prolific milk production, and any general statements made may be taken to apply particularly to that area.

Definition.—The Factory or Creamery method of Dairying may be defined as the system of collecting milk (or cream) at a central point, and in a central plant, with the object of dealing with it rapidly, hygienically, efficiently and economically for its conversion into pasteurised whole milk and or any one of several factory products such as butter, cheese, casein, milk powder, ghee, etc. ; and for the large scale packing, storage, transport, distribution and sale of such products.

Advantages of Factory System.—As developed in dairying countries over the last 50 years particularly, the advantages of the factory system to milk producers may be enumerated as follows :—

(*a*) Removal from individual milk producers of the irksome and daily recurring tasks of home manufacture of dairy produce—with diverse systems of manufacture, often employment of unhygienic methods and large expenditure of labour which could more profitably be employed on increasing production.

(*b*) The centralisation of manufacture has enabled science to evolve economical, hygienic and *standardised* methods of manufacture and devise highly efficient machinery for this purpose—such machinery and methods being entirely beyond the reach of cottage industry.

(*c*) Mass production results in lower manufacturing costs and enables the employment of trained technical personnel, makes possible the application of benefits from scientific research, and at the other end, after manufacture, large scale distribution and sale keeps marketing costs down.

(*d*) The centralisation of manufacture, in relatively few factories, with standardisation of methods, facilitates Governmental control and inspection, the application of pure food laws, with the fixing of proper nutritional and hygienic standards, and also facilitates Government grading, and, in some instances even the packing and sale of products under a national trade mark and guarantee, (*viz.* Denmark and New Zealand).

(*e*) The central factory or creamery, with its extensive laboratory records, is a starting point for Government field work on hygienic control of production, on farms, for herd health inspection and herd improvement work. Generally the Factory management can guide Government field Officers to herds, farms, localities, or whole districts where improvement work is most required, and can advise on improvement recorded.

(*f*) Naturally the existence of a factory as a permanent source for disposal of Dairy produce, itself encourages development of production of milk and the building up of the type of milk producing animal best suited to the product manufactured.

(*g*) Factories can also, and do, serve the farming community by arranging large scale purchases, at cheap rates of bulk commodities in general use—*viz* fertilisers, cattle feed, farm machinery and requisites. This is a highly developed department overseas. The factories merely cover their costs and sell without profit. They also finance certain aspects of farm and herd improvement at low

interest rates, and provide, on hire, farm implements, the cost of which is beyond the reach of smaller farmers. The examples of different types of assistance, given at bare cost to farmers, can be multiplied many-fold and depend only on the willingness of the farming community to support such subsidiary services. A notable further example is maintenance of a verterinary service by some factories.

The foregoing notes cover in a very condensed form the advantages conferred on producers and the industry as a whole by the centralised factory or creamery system. The next object is to extract from this what can be of benefit to Indian Dairy Farming as it exists today. Unfortunately, it is difficult to draw any near comparisons, or even apply the greater part of the factory system, as, fundamentally, conditions in India are so very different from conditions overseas. Let us take an example. The farmers in a district, say in New Zealand, decide their district is developing and can have a factory of its own. As few as 30 farmers with herds of say 60 to 100 cows, can form a co-operative, obtain finance, and build their own factory. In 10 or 15 years it might well grow to an association of several hundred farmers, with a large central factory and all the subsidiary services and activities enumerated above. But in this country milk producton in large quantities is not undertaken by individual farmers, so that the establishment, from the outset, of a truly co-operative, large, or even moderately sized, enterprise is impossible. In making the statement "Impossible" one ought to say "Impractical"—because a large dairy utilising anything from 20,000 to 80,000 lbs. of milk daily cannot accept milk in lots of 4 to 10 lbs. per time from some thousands of individuals—and that twice a day. Preliminary bulking at some intermediate points is essential. Hence the present usefulness of *middlemen* and the *future opportunity for village co-operatives*. Conditions being as they are, with average individual milk production at (a very liberal figure) 20 lbs. per day per cultivator, the factory or creamery system in India, so far as it is developed, has grown up on the only possible lines. There are a few, unfortunately very few, dairy factories, or dairies, in India that would qualify for that term overseas. There are many small manufacturing dairies, the counterpart of which does not exist elsewhere. There are many "Creameries" in villages where milk is collected, and skimmed, cream sold to manufacturing dairies, and casein or edible curd prepared. These small dairies are privately owned.

With this set up, which is well known to every person associated with Dairying in this country, what steps can be taken to improve the lot of the producer and encourage herd improvement?

I would say :—

(1) Encouragement of the continuance of such worthy manufacturing enterprises as now exist and also encouragement of the establishment of others, whether by individuals, limited companies, or other form of organisation willing to undertake processing and manufacture. Any form of outlet for milk is a direct encouragement to producers to maintain or even increase production which now more than ever before, is necessary.

(2) Such concerns will, for the time being, have to obtain supplies through the present channels—*viz.* middlemen, milk collectors or cream merchants (Creamery owners).

(3) However this is where improvement can be made in the first instance, and from where it can slowly spread to full co-operative manufacturing and marketing status. *The middlemen must be displaced by co-operative producing units.*

To digress for a moment it may be said that the middleman, milk collector and creamery operator is one of the greatest brakes on dairy development. Manufacturing

concerns buy competitively from small creameries at openly known market rates. How much of the rate eventualy finds its way back to actual producers is a question very difficult to answer. But from experience (and logical reasoning) it is quite clear that the middleman will retain as much as he can—often a disproportionately large part, and this is the money that by a co-operative producing enterprise could go to benefit and build up the co-operative effort.

Item No. 3 is the truly necessary improvement required and from which all subsequent development can spread. This is where the "Creamery" system can be employed to benefit the producer (considering the "Factory" or large manufacturing unit to be beyond his reach for the time being).

Take any village, say in Gujarat, where milk production is fairly concentrated. Some villages, with attached hamlets, can show daily collections of 4,000 lbs. of milk. In relatively small areas several such villages and hamlet groups exist and reasonably sized areas can show a large daily total collection of milk running into thousands of pounds. It is beyond hope at present to weld all this into a single co-operative. But suppose a start was made in a village. At present it has a privately owned "Creamery"—that is, milk collecting depot and separator. The owner buys milk as cheaply as he can and sells his milk, his cream or his casein at as high prices as possible and pockets the difference. The producer has a small regular daily income (as small as the middleman can make it) which being small and daily, disappears as regularly as it is paid. Suppose somebody—the Government through its organisation devoted to co-operative enterprise—organised a village to own its own creamery, or milk collecting and selling service, and suppose in course of time several villages could be so organised, first the co-operative small creamery has come into its own, secondly the production of several, collected at a central point, would make the larger factory system, on a co-operative basis, a possibility. In the first instance, the middleman's profit would accrue to the village co-operative for development and extension of services, in the second instance, the factory profit would accrue to the association of village co-operatives. An intermediate step might be the acquirement of individual village co-operatives of shares in any existing limited company, factories, or privately owned manufacturing concerns.

The Village Co-operative.—As the individual farm is the basic unit of co-operative enterprise in dairying countries, so the village must be made into the basis unit in India. How such a co-operative should be organised or operated would require a very full set of notes in itself. Briefly, it would require a fair measure of agreement among the village people, including :—

(*a*) Agreement to accept a fixed rate of payment, somewhat less than the full market value of the produce, part (say the middleman's profit) to be set aside for the operation and improvement and enlargement of the co-operative. In a true Dairy co-operative all organisational and administrative duties are performed free by members of the co-operative. Full-time employees—such as labourers in the creamery, etc., to be paid for as well as operational expenses of creamery.

(*b*) Milking of cattle of members of the co-operative would have to be done at a central place under supervision (Government assistance required here in the first instance) and proper sanitation observed, and proper recording of milk production to be maintained at this point. Periodical fat tests would have to be performed for each animal to fix relative values for milk. An interim flat rate payment on poundage of milk would have to be fixed with periodical additional payments to compensate for higher fat content of better milk. The co-operative would be expected to show a margin after paying for milk and operating the creamery, this money to

be utilised for extension work, improved creamery equipment, etc., part to be returned periodically to members as a bonus, or kept in a fund for financing cattle purchase of members at low interest rates, maintenance of stud bulls, etc.

(*c*) One of the first things to emerge from such a co-operative with its milk recording system would be definite proof of which was the really payable milking stock. This should automatically encourage breeding from such stock and the elimination of unprofitable stock. Intelligent compilation of milk records and their interpretation to members of the co-operative should do a lot of good—it would also arouse a competitive spirit in cattle owners to have the best animal in the village.

It may be pointed out that among the advantages accruing to co-operates will be the improved possibility of obtaining Government assistance. (Government cannot easily assist thousands of unorganised producers which means more or less direct dealing with each individual. But producers through their co-operatives would have direct approach and contact. It is believed by the writer that milk production has sharply declined in Gujarat due, among other causes, to shortage, high cost of, unequitable distribution of, and profiteering in concentrates for cattle feed. Co-operative associations of producers might well have made much better use of what products have been available in the last few years.

(*d*) As mentioned, details of a co-operative would occupy a large amount of paper. These are just brief indications of how it might work and the early good to result.

(*e*) The only thing to hinder organisation of co-operatives at present is the existence of middlemen, particularly middlemen native of the villages in which co-operation was to be introduced. By devious means they could well wreck any attempt at a beginning unless this eventuality were kept in sight. I do not doubt that actual purchasers of village produce in the form of milk or cream, including commercial dairies, would be willing to assist in beginning such co-operative enterprises by paying a premium for produce of co-operatives. Government might also subsidise them.

Conclusion.—The writer does not underestimate the difficulties that would exist in establishing a village co-operative creamery. Quite possibly notable work along these lines has already been done in some parts of India. As mentioned in the first part of these notes, they apply particularly to Gujarat where, up to now, no co-operative creamery or village dairy organisation exists. The object of these notes is not to show how a particular existing system can be uprooted and replaced by something new—an impossible immediate undertaking—but how the present system may be gradually shaped to take advantage of accumulated experience and practices in other Dairying countries; in short, how the creamery system first, and then the larger factory system may be grafted on to the Dairy Industry as it exists.

APPENDIX III (3).

CO-OPERATIVE CATTLE INSURANCE AS A NECESSARY AGENT IN ENCOURAGING THE BREEDING OF A BETTER TYPE OF MILCH ANIMALS AND DEVELOPMENT OF DAIRYING IN RURAL AREAS.

(*a*). The Indian Council of Agricultural Research.

Insurance against unexpected losses caused by the destruction of or damage to the means of production is universally recognised to be an indispensable feature of any commercial enterprise in the modern world. Without such insurance no industry

can survive serious losses. The smaller the enterprise and the poorer its resources the greater is the need for insurance. The livestock industry is no exception to this rule : particularly in the conditions obtaining in India a sound system of insurance is an urgent necessity. In this country cattle breeding is almost entirely in the hands of small farmers who own only one or two animals each, and these animals are often their sole means of subsistance. Contagious diseases are widely prevalent and these either kill the animals or incapacitate them for work. When a farmer loses his animals he is generally compelled to borrow money at usurious rates of interest in order to replace his stock : he is always encumbered by these debts which rob him of most of his earnings. Insurance will relieve the farmer from his debts, secure for him a better return from his animals and thus encourage him to pay more attention to them and to acquire a higher class of stock. Insurance will also attract more private capital to cattle breeding and dairying, for by eliminating the major risks from death and disease the greatest obstruction to investment is removed. Cattle breeding now, is, for all practical purposes, the poor man's affair. The direct and indirect effect of insurance should be the establishment of a greater number of adequately capitalised concerns which are in a position to finance the multiplication and exploitation of improved cattle. The necessity of insurance has more or less been recognised all over the country but the difficulty has been in devising a practical method of working, an insurance scheme.

Other countries of the world which have been successful in the exploitation of their livestock have recognised the importance of insurance and its necessity for the development of cattle. The growth of insurance has not, however, been as rapid or as widespread abroad as one would expect. There are many reasons for this. The first is the practical difficulty in devising suitable machinery for the frequent inspection, identification and valuation of animals which is necessary and for the assessments of risks. Secondly cattle breeders in other countries almost invariably insure their farm buildings and equipment against lightening, fire etc., and in doing so cover their animals too against death from these causes. Thirdly death represents only one aspect of loss and often not the main one. Reduction in value of an animal may be due to such obvious reasons as the effect of diseases or of accident but in innumerable instances the cause cannot be specified. Fourthly since time immemorial losses on livestock as on plant crops have appeared to be inevitable and in countries where the livestock industry is supported by adequate capital such losses are provided for as a normal item of the budget. Fifthly although loss from disease is very heavy it is covered to some extent by much closer control of contagious diseases through legislative action and financial assistance from government than what is provided for in India. It may be mentioned that the average expenditure incurred by Governments in India on all services for livestock is only about half an anna per head per annum as against the equivalent of about Rs. 3 per head per annum in the United States.

An attempt has been made to obtain details of the methods followed by other countries in effecting insurance. Literature from the United States, Great Britain, New Zealand, Australia, Denmark and Switzerland has been obtained. A summary of this is given in the appendix. While this literature gives a general insight into the working of insurance, information relating to the financial aspect of insurance or the share of the burden borne by Government is not available. Briefly stated there are comparatively very few private companies accepting anything likeoverall insurance of livestock. In Great Britain a few companies accept risks due to death caused by accident, parturition and disease excluding death caused by compulsory slaughter under the Diseases of Animals Act. Animals are valued on the basis of market rates and premiums are based on the sums insured and on the period and scope of cover.

In the United States also the development has been very limited. Only one capital stock company and about half a dozen small local mutual organisations specialise in such insurance. They insure animals against deaths by fire, lightning, accident, parturition and transport hazards. Livestock is valued on market rates and premiums vary according to the risk covered and the period of cover. Local mutual organisations in addition to insuring against death provide veterinary help. The value of an animal is appraised by a country officer and a premium at the rate of 5% of the appraised value is charged. On occurance of death the owner is paid 60 to 80% of the appraised value.

In the New Zealand and Australia only high class pedigree animals are insured and these against accidental death only.

In Switzerland the decision in regard to the introduction of insurance is left to the Cantonal Authority. It is decreed that when 18 or more farmers in Canton apply for insurance the Cantonal authority should take steps for bringing into existence an insurance association composed of the applicants. The association sets up its own executive and other machinery for the operation of the insurance scheme. The Government have laid down model bye-laws for insurance associations, and grant a subsidy to associations formed according to these by-laws. These associations are practically independant, subject only to an inspection by a duly appointed Government inspector. It is not known what the amount of the subsidy is. Probably the work of the various cantons is coordinated by a central body but details are not available as to how this co-ordination work is carried on.

In Denmark cattle insurance is done by co-operative societies some of which are very small and some very big. It is not clear from the literature received as to what part the government plays in livestock insurance in Denmark, and what subsidy, if any, is given. The literature shows that insurance has had a chequered career ; various experiments have been tried and it is found that neither small organisation nor large ones worked successfully. They have found that the ideal is a large organisation with small branches working in compact areas. If the area is small it is unable to bear the whole burden of a bad year's losses. On the other hand, if the area is large the supervision of the animals and the control of the work are not sufficiently effective to make the scheme a success. They have accordingly found that what is necessary, is a large organisation established at a central place with small branches working in compact areas.

It will be seen from the above that the information received is scanty and is lacking in details particularly in regard to the part played and the financial contribution made by Government. It is, however clear that in all these countries the initiative is taken by the breeders and they work the insurance scheme with or without Government help. Private companies like those for insurance of human lives are practically non-existent. Secondly no attempt seems to have been made to evolve a scientific method of assessing risks or calculating premia. Animals are valued at market rates and an arbitrary rate of premium is charged. This as far as can be seen is about 5% of the value. There seems to be provision, however, to charge additional premium retrospectively if at the annual general meeting it is found that during the previous year the income from premium was insufficient to meet the claims. Thirdly, it has been found particularly in Denmark, that neither a small organisation nor a large one works successfully. A small one has the advantage of being able to exercise close supervision of the animals, but in years of calamity it is unable to bear the whole burden of risks. A large organisation has the advantage of being able to divide risk over a wider base, but fails because supervision tends to be weak. What is found

successful is a Central organisation with branches working in small units of compact areas. *Fourthly, the insurance is almost invariably against death only the reason* being, probably, that unlike what occurs in India uneconomic producers are slaughtered for meat.

In the present conditions of poverty and illiteracy in India the breeder is unable to take the initiative and to bring into existence an organisation for the working of insurances—and that must therefore be done entirely by Government. It must be realised that insurance is but a measure of cattle improvement, and government expenditure on it is as much a necessity as expenditure on other measures of cattle improvement like castration, bull distribution, disease control and so on. Frequent medical examination, prompt attention to outbreaks of contagious diseases and the adoption of prophylatic measures, which are the inevitable economitants of this insurance, should constitute a first class healthy service leading to the prevention of diseases and the reduction of losses due to death and debilitation. The money spent on insurance is more than repaid by these benefits and the consequent increase in the capital value of the stock insured. It is estimated that to begin with an annual expenditure of about Rs. 1,40,000 will be required to insure nearly 75,000 good animals against death between the productive ages of 3 to 10 years. As the number of insured animals increases so the charge per head decreases, and as experience is gained and knowledge of the risks becomes more accurate the rates of premium can be progressively varied until eventually the scheme becomes financially self supporting.

The main principle in insurance is that it should cover unexpected losses. In the case of cattle the losses arise from two reasons, *viz.* the death and the necessity for casting caused by factors which render the animals uneconomic producers. In assessing these risks we are seriously handicapped for want of sufficient data. Absolutely no figures are available for rural areas where the large majority of cattle are bred. The figures obtained from government farms, however, give a rough indication of the magnitude of the losses and may enable a beginning, however, crude to be made.

From the limited data available from farms it is found that animals are disposed of for a variety of reasons like low yield, contagious absorption under trouble, sterility, physical defects and so on, As far as the Government farms in India are concerned the disposal from the farms for any of these reasons is as good as death. And the castings are considerable. It is found that the average length of total life on farms is 10·3 years for the she-buffaloes and 9·2 for cows, 5·12 years for the he-buffaloes and 8 years for bulls. Of these the productive life is 6·1 years or 5·5 lactations for cows and 7·2 years or 6·3 lactations for buffaloes. If the insurable age is limited to a range of 3 to 10 years that should therefore cover the productive period of most of the animals.

The mortality figures available from Military Dairy Farms for 4 years show that the annual loss from natural death varies between 2·5% and 5·4% in cows and 3·7% and 5·2% in buffaloes. During the same period *castings for the reasons stated above* amount to 20 to 56% in cow, 9 to 13·5% in buffaloes. There may be something abnormal in the year which accounted for 56% of castings in cows, but the figures are more illustrative than exhaustive. They indicate a serious but it is believed a usual state of affairs and show that factors which incapacitate animals for production and necessitate their castings are responsible for more losses than those from natural death. In other countries castings need not represent such a serious loss as it does in India, for culled animals generally fetch comparatively high butcher prices ; in fact if the animal is discarded as soon as it becomes uneconomic the loss incurred may be very small indeed.

There is another serious source of loss suffered from Foot and Mouth disease which is only partially reflected in the figures given above. Foot and Mouth disease may not actually kill an animal but causes very serious losses in milk production. The after effects of an attack may be economically devastating. The earlier in a lactation an animal is attacked the greater is the loss in milk yield, and if the attack is virulent the animal goes completely off yield. During the same period as referred to above the incidence of Foot and Mouth disease in military farm animals has varied from 2·4 to 22% in cows and 4·1 to 8·7% in buffaloes. It appears that on the average 10% of all the losses in India are affected with Foot and Mouth disease each year. The average loss in milk production in a cow thus affected is estimated to be about 30% and it is calculated that at the rate of 2 annas per pound of milk the annual loss due to drop in milk yield caused by Foot and Mouth disease is about 18 crores of rupees. In normal times the loss may be a third or fourth of this figure.

It will be seen from the above that castings cause more losses than natural death itself and that to afford complete protection to the owner the animals should be insured, both against death and against factors which appreciably reduce their economic value. It is, however, too ambitious at the present stage to afford a complete cover against all these losses. It is therefore suggested that to begin with insurance may be confined to loss from natural death between the ages of 3 and 10 years. After sometime when we gain experience in cattle insurance work and we have acquired enough data for the proper assessment of the various risks have been collected insurance may be extended to cover them.

As explained above there are no data available by which a scientific calculation of the premium to be charged can be made. It is therefore suggested that as is done in some of the countries for which information is available an arbitrary rate equal to 5% of the value of the animal may be charged as the annual premium. Thus if an animal is valued at Rs. 300 the owner of the animal will pay a premium of Rs. 15 and if his animal dies he will get a sum of Rs. 300. This is but a simple statement of the plan. A complete set of rules and regulations has to be drawn up for the operation of the scheme. The assessed value of the animal should be less than its market value to prevent what is called the moral hazard of the owner killing his animal surreptitiously to obtain an inflated amount for which it may be insured. Again in the case of owners possessing several animals the dangers of adverse selection should be avoided by insisting on the entire herd being insured. Otherwise, an owner may offer only those animals which he knows are poor in health. Such details may be left over to be worked out later.

According to the available figures the mortality between the ages of 3 and 10 years on farms is about 4% per annum so that a premium which is equal to 5% of the value of the animal will maintain the claims ratio sufficiently wide to meet all the liabilities especially if the work is carried on over a period of years.

It is clear from the experience of other countries that the scheme can be worked successfully only in small compact areas. Then only will it be possible to examine the animals frequently for health, watch their movements, attend to outbreaks of diseases and carry out other measures necessary for the operation of insurance. Secondly it should be the aim to protect not only the small breeder but also the comparatively larger owners in order that more capital may flow into the business of cattle breeding. It is therefore suggested that as a beginning one insurance unit be established in each of the important breeding tracts of the country and another unit in each of the important cities for taking up animals of dairy farms, or of owners possessing comparatively larger numbers; within a radius of 25 miles. For a start ten rural centres and 15 urban centres may be taken up.

It is estimated that one Veterinary Assistant Surgeon assisted by four Stockmen will be able to examine about 3,000 animals once in six months, protect them against contagious diseases and carry out the various duties required for insurance. He will require a clerk and also a peon. On receipt of a proposal for insurance he will examine the animal concerned and prepare a report of its conditions. The animal will then be valued by himself and the livestock officer (or his representative) of the Province in which the unit is located. The proposal will then be forwarded to the Central Directing Committee described below who will after such verification as they think necessary issue a policy on receipt of the prescribed premium.

In the experimental stage it is proposed that the Central Committee should be composed of the Animal Husbandry Commissioner with the Government of India, a representative of the Superintendent of Insurance and representative of Provincial Livestock officers and an Insurance expert. The Committee will be responsible for determining the policy, for reviewing the work at intervals and for giving general direction and guidance. During the period the executive body for operating the scheme will be the Animal Husbandry Bureau of the I. C. A. R. By reason of its being responsible for registration of cattle, for marking animals for identification and for recording births, deaths, sales and transfers of registered animals the Animal Husbandry Bureau is obviously the best body for operating the scheme. To carry out this work the Bureau will require a staff of one Manager, one Statistical Assistant, two computors, two clerks, one stenographer and two peons. This Central body will, besides carrying on the day to day administration of insurance, undertake the collection and study of data necessary to evolve a scientific method of cattle insurance with a view to make the scheme financially stable.

The following is a rough estimate of the cost :—

		Rs.
(a) *For one unit*—		
1 Voty. Asst. Surgeon		100
4 Stockmen		120
1 Clerk		80
1 peon		20
	Total for one month	320
	Total for one year	3,840
Travelling and Contingencies		1,160
		5,000
Total annual cost for 25 units		125,000
(b) *For Central Directing Committee*—		
One Manager per month		300
One Statistical Asstt.		200
Two computors		200
Two clerks		160
One Stenographer		125
Two Peons		40
	Total for one month	1,025
	Total for one year	12,300
Travelling and Contingencies		2,700
	Total	15,000
	GRAND TOTAL	1,40,000

(c) *Income from Premium* :

In 25 units there will be a total of 75,000 animals. At an average value of Rs. 300 per animal the premium from 75,000 at 5% will be .. 11,25,000

(d) *Claims*—Assuming—

4% mortality the claims to be paid will be 9,00,000

The statements under (c) and (d) are crude estimates based upon the unjustifiable assumption that all the 75,000 animals in the selected areas will be offered for insurance. The figures are however given for purposes of illustration. In the light of experience gained the premium rate can be suitably varied to balance the budget but initially an annual allotment from Government of Rs. 1,40,000 is necessary for the maintenance of the staff.

The examination of the above proposal by Government will necessarily take time. In the meanwhile it is suggested that the Central Directing Committee may be called immediately to consider the proposal and to decide what preliminary data should be collected. It will be borne in mind that absolutely no data are available at present for providing a basis of calculation of the premium or of assessing risks. Very few figures are available in villages. But there are about a hundred cattle breeding or dairy farms in India, from whose records valuable information can be collected. If the Committee indicates what data should be collected five men on Rs. 100 each per month should be able to collect sufficient data in the course of six months. With the help of these men an acturial or statistical assistant on pay Rs. 250 will be able to analyse them. The cost of the preliminary investigation will be :—

	Rs.
5 Clerks on Rs. 100 p.m.	500
1 Statistical Asstt. @ Rs. 250	250
	750
Cost for nine months	6,750
Travelling and Contingencies	1,750
TOTAL ..	8,500

Before being sent out the clerks will be trained in the Animal Husbandry Bureau so that they may be able to know what kind of records to expect in the farms and where they should look for the required information.

APPENDIX.

Livestock Insurance in various countries.

This is a summary of the information on the above subject received so far by the Indian Council of Agricultural Research from foreign countries. These include the U. S. A., Great Britain, New Zealand, Australia, Denmark and Switzerland.

A. *United States of America* :

Most of the farmers in the U. S. A. have their farmsteds, including livestock insured against fire and lightening. In most cases loss from windstorm is also included. These risks are therefore not covered by purely livestock insurance organization which term refers to insurance of livestock against loss by disease or accident. Livestock Insurance in this sense has had limited development in the U. S. A. Only one Capital Stock Company and about half a dozen small local mutual organizations

specialize in such insurance. Most of this insurance has covered work—animals particularly mules, but a limited nubmber of cows and other bovines have also been insured.

The Hartford Livestock Insurance Company and a few other smaller companies cover loss of livestock by fire, lightenings, accident, disease, parturition and transport hazards, Livestock are insured for their market value and premiums vary according to risks covered and period of cover. They insure draft, dairy and beef animals, and also show animals. Indentification is by description and/or marking.

Local mutual organizations :

These are called the Mutual Livestock Replacement or Protective Associations, and in addition to cattle insurance aim at providing veterinary aid to the members. These are incorporated under State laws and are co-operative organizations under board of directors and having other features of such organisations. The value of an animal for insurance is arrived at by an appraisal made by a county officer. The coverage is 60 to 80% of the appraised value and the premium rate is about 5% of the appraised value. The Association charges a small membership fee at the time of application. All policies carry an assessment clause whereby members may be required to pay under special circumstances, amounts in addition to the specified premiums. This contingent liability is limited to an amount equal to the cash premium.

The losses for a 6-year period for a typical Association were 2·38% per year on cattle and 4·1% per year on horses. Mortality rates were considerably higher for older animals than for younger animals. Losses were considerably lower on high valued animals. About 4/5 of the losses resulted from natural causes and the rest were accidental.

B. *Great Britain* :

There are a few British Companies accepting insurance of livestock in Britain Proposals reach the company through agents and cover dairy and sometimes beef cattle. Risks covered are death by accident, parturition and disease excluding death by compulsory slaughter under the Diseases of Animals Act and some similar cases. Premiums are based on sums insured for and vary as the period and scope of cover. Valuation is based on market value. Identification is by name, description and/or ear markings. There is no regular system of inspection. A veterinary surgeon's report may be required at the commencement of insurance.

C. *New Zealand and Australia* :

Only high class pedigree animals are insured by a few insurance companies mainly against accidental death. There is no State Insurance of Livestock. Nor is livestock insurance very popular. No details have yet been obtained.

D. *Switzerland* :

Decision in regard to cattle insurance is left to the various Cantonal authorities. When at least 18 farmers make an application for insurance the Cantonal Authority should form a society of the farmers. The society appoints its own executive to conduct the work. The society is subject only to an inspection by a government inspector. They receive a subsidy from government and have to work in accordance with the bye laws laid down by government.

After the formation of the society the Secretary draws up a list of animals belonging to the parties. Out of these very young calves, very old animals, sick or suspected animals and animals belonging to dealers or located at places inconvenient

for inspection are not insured. Animals which are shifted too frequently or are ill cared for may also be refused insurance by the members. Newly purchased animals cannot be insured for ten days unless certified healthy by a veterinarian.

Sale, purchase, tranfer and killing of cattle must be notified within 8 days Contravention of this renders the owner liable to fine and cancellation of insurance on those animals:

Insured animals cannot be insured for the same risks by another company.

The only entrance formalities are the valuation and the filing of complete description brand, tattoo/etc. of the animals by the Valuation Committee and the registration of the animal in the book. Animals are inspected each year in May and November.

An entrance fee is charged for each animal. Rates of premium are decided by the General Meeting who also decide about supplementary premiums if necessary. These must be paid within 14 days of the decision failing which a fine is imposed

The Committee must be informed in all serious cases of sickness or loss of condition. First aid and veterinary aid must be provided and instructions of the veterinary surgeon must be followed. In special cases the society may provide additional advice at its own cost.

Damages are paid on loss following illness or accident and the amount varies according to the conditions of health and state of meat on death. The Committee decides on the amount of damage to be paid and this payment is made within 30 days of the accident.

No damages are paid if the death or the accident is caused by the owner's negligence and similar causes.

Disciplinary fines are imposed and in certain cases the members are deprived of their rights.

E. Denmark.

A Society is set up on Co-operative lines and a Board of Directors elected. The purpose of the Society is to refund the loss which a member may suffer by the death of horses or cattle, when the death is a consequence of illness or accident, but do not originate from cattle plague, fire, floods or other acts of God as well as war. Only such cattle and horses as are found to be absolutely healthy and well kept are insured. Very young and old animals are excluded except on special terms. The compensation to be paid is reduced if the loss is caused by negligence of owner, his failure to privide adequate veterinary aid or his failure to obey the instructions of the Doctor, The maximum values for cattle and horses are fixed. Animals of lower value are not insured. The rules provide for the prompt payment of premium and compensation. In case the compensation to be paid becomes too great the Board can take a limited loan or/and levy extra fees from the members. Under the Rules the Board has very extensive powers.

Cattle Insurance in Denmark.

Cattle insurance in Denmark is done by Co-operative Societies. The Societies are usually very small comprising only single village or district and often only a certain class of the inhabitants in the village for instance big or small farmers.

Quite often Horse Insurance Societies and Cattle Insurance Societies are separate but it does happen that the insurance societies are mixed but then they have a department for horses and another for cattle. Besides these small co-operative societies a few big societies exist which comprise for instance a Taluka or even a District. Finally there are 2 societies comprising the whole country. It has been tried several times, especially during the war year of 1914 to 18, to form limited companies doing business in this kind of insurance but they all eventually went bankrupt and in Denmark as well as in the other Scandinavian countries no cattle insurance exists which is not based on mutual assistance and co-operation. Most of the small co-operative societies have certain limits for the number of cattle which is admitted to the society. And they do not usually admit horses which are used for other purposes than agriculture. Therefore a number of big farmers and other owners of cattle and horses cannot become members of the small societies and they are the principal members of the big country-wide societies.

It is normally considered that small societies are preferable because the big individual risks which as a rule follows this kind of insurance can be limited in these small societies where the members know each other and control each other. The weakness of the small societies is that the basis of equalisation is too small if for instance a serious illness should strike a comparatively big number of cattle within the limited area of the society. Insurance can therefore be more or less theoretical because the premium which is to be paid will increase at the same rate as the loss. If the societies would try to form a reserve fund, the danger in this respect could be reduced, but the small societies do not usually like to do that and the result is that they sometimes have been dissovled when there comes times with heavy losses. The best way to consolidate the small societies would be to organise the in mutual insurance societies comprising the whole country, but operated in such a way that the small societies keep their self-government and thereby the mutual interest.

APPENDIX III (3).

(*b*) Sri Rao Sahib M. S. Palaniappa Mudaliar, B.A., Honorary Secretary Coimbatore Co-operative Milk Supply Union, and Dr. Zal R. Kothavalla, B. Ag., Ani Hus. (Bom.) B.Sc. Agri. (Edin.), N.D.D. (Scot.), D.Sc., Dairy Development Adviser to Government of India.

INTRODUCTION.

Cattle whether for work or milk form the main asset of the poor agriculturist in India. The investment in cattle is generally either from the money carefully saved for years or borrowed by the cultivator from the money lender at an exhorbitant rate of interest, so that the maintenance of his cattle possession in sound and serviceable condition for as long a period as possible is the constant care and anxiety of the poor ryot. What with the difficulty arising out of the scarcity of fodder in certain seasons of the year and the lack of protection of his stock against bovine diseases, what should really be loves, labour, is a night-mare to the poor agriculturist. To those working in close contact with the agriculturist it is a well known fact that his natural tendency is not to go in for costly animals (either for work or milk production) of a better quality,—as that involves the investment of a larger amount of capital —mostly borrowed—and greater risk of losing the animal through bovine diseases or other adverse circumstances. It is an irony of nature that the better-bread animals fall an easier prey to the stress of circumstances. This outlook of the agriculturist developed as an outcome of bitter experience of generations forms one of the most serious handicaps in raising the *general standard* of the cattle wealth of the country.

The cultivator realises the advantages to be derived from maintaining better type of cattle, but he feels at the same time that the risk to be undertaken in the matter goes much beyond his means. It is in this respect he is required to be fortified in order to encourage him to strive for improved stock, and there is no better way of achieving this than to protect his interest through the insurance of his cattle. Cattle insurance is more or less an unknown thing in this country, and where attempts have been made to introduce it, the amount of premium demanded is so high as to make it prohibitive even for the owners of valuable highly pedigreed stock, not to speak of the poor farmer, to take advantage of it. An organisation which would protect the interest of the individual farmer in this respect is, therefore, to be thought out and there cannot be a better one than a Co-operative Cattle Insurance Society which would fit in with other co-operative efforts designed to promote his interest, such as a Co-operative Milk Union which assures him a market for the milk and thus encourage him in looking after his stock better.

Principles Involved.

2. Since the giving of an outline of such a Co-operative Cattle Insurance Scheme on hypothetical factors would be a difficult matter and would not serve any practical purpose, a detailed scheme prepared with reference to the Coimbatore Co-operative Milk Supply Union, with the working of which the authors are intimately connected is given below as an illustration. Before, however, the details of the scheme can be dealt with some of the principles involved in working out such a scheme will have to be considered and they are as follows :—

(*i*) *Fixing of Sum Assured.*—The risk to be undertaken on an animal will not be its actual value on the date of entry into the scheme, because, firstly in the case of milking animals the value increases till about the 3rd lactation and then decreases as the age increases. Secondly, the owner of the animal will not be inclined to take care of it, when it falls ill, if he is sure to get the full value on its death. And thirdly even in the case of human beings the risk undertaken on the life is only a small portion of its real worth. The proposal, therefore, is to insure the animals from the 3rd to 10th year, Sum assured will be the average arrived at on the basis of the table given in Annexure " A " and on the value to be fixed by the valuing committee. It is therefore proposed that the amount to be assured to the owner should be somewhere about 70% of the actual value of the animal at the time of the insurance.

(*ii*) *Selection of Animals.*—The risk to be undertaken will only be on selected livestock. A milch animal begins to have its real value after its first calving. It keeps on increasing in its utility value to the owner till the fifth or sixth calving. The maximum life of a well bred animal is on an average about 15 years but its value deteriorates after the age of ten.

(*iii*) *Medical Fitness and Valuation.*—Apart from the competent officer who will be employed by the Society to medically examine the animals to ascertain their condition at the time of insurance, the government department dealing with animal husbandry would also permit its staff working in the area of operations of the Union, to give medical certificate of fitness of the animal on an agreed fee. This amount will be payable to the government officer as his private fees, by the Society.

(*iv*) A Committee constituted by the Board will value the animal and fix the sum to be assured. The sum so arrived at will remain constant upto the time the animal completes 10 years of age.

(*v*) *Agents.*—No Insurance Scheme can work successfully without properly accredited agents being appointed as they will have to canvass business. Every society affiliated to the Union will be treated as an agent. Any other Co-operative

Society or person approved by the Society will also be enrolled as an agent to canvass business. The Commission payable to be fixed at 6¼% of the premium collected both from the owner and the Government. The agent will be held responsible for all the particulars given by him regarding the animal. All premia will be annual and payable in advance.

(*vi*) *Instrument of Contract.*—The policy will be in the form of a certificate of risk with a statement of contract and a schedule giving details, of the owner, description of the animal, the value of the animal, the name of the agent, the premium payable annually, the date from which risk is undertaken, the value of the risk undertaken on the animal, the date of the expiry of risk unless renewal premium is paid and such other particulars of the contract. It will also contain the general conditions nd regulations and it will be duly signed and sealed. All animals shall be identied by a mark which will be the patent of the Society.

(*vii*) *Claims.*—The death of an animal must be reported to the agents or the Society by the member owner and they in turn will intimate the same to the authority concerned in a prescribed form to which will be attached a certificate from a recognised veterinarian of having seen the dead animal. These two certificates shall accompany any claim form. The claim amount shall be paid by the Society and be handed over to the authorised agent of the Society, who will sell the carcase at the best market rate, to the credit of the Society.

(*viii*) *Premium—Recovery from Government.*—The Society shall prepare a monthly statement of 75% of the premia payable to the Society by the Government and get payment of the same, instead of applying for individual cases, to avoid unnecessary correspondence.

(*ix*) *Recovery of Premium Amount.*—Where a Milk Society is the Agent, the bye-laws may be amended to permit deduction of premium and renewal premium amounts due from its members from milk payments. The agents must, however, see that the renewal premia are collected within one month from the date of expiry of the risk as otherwise the cover on the animal would lapse.

(*x*) *To be run mainly as a Co-operative Organisation.*—The Co-operative character of the Scheme will be maintained by admitting all policy-holders as members by receiving a nominal share capital of 4 annas. The Board of Management will consist of the President and the Vice-President of the Coimbatore Co-operative Milks Supply Union, Limited, as ex-officio President and Vice-President, and seven members elected by the policy-holders from among themselves. The Officers of the Animal Husbandry department in charge of the district or circle will also be ex-officio Director. The Society will be affiliated to the Co-operative Milk Union. There will be an Executive Committee entrusted with the day to day management, including the President and the Vice-President and three other members of the Board elected from among themselves.

(*xi*) *Expert Advice.*—The Society shall engage a consulting actuary to advise the Society on actuarial matters. Apart from advising the Society on the preparation of premia tables, he shall also carry out the periodical valuations. For this work he shall be paid by the Society.

SCHEME FOR CO-OPERATIVE CATTLE INSURANCE.

3. This scheme is proposed to be run in conjunction with the Coimbatore Co-operative Milk Supply Union, in the district of Coimbatore on the following terms :—

(*a*) The number of milking animals that will come under this Scheme will be about 5,000, of which half always will be in milking. Thus the number of milking animals will be 2,500 and non-milking animals about 2,500 at any time of the year, under protection of the Scheme.

(*b*) The risk to be undertaken under the scheme will be limited between the period the animal begins to calve, i.e., about the age of 3 to 4 years and the end of the 5th lactation or say the age of 10 to 11 years, depending on the group in which it is included, taking into consideration the breed of the animal, the locality in which it is kept, the status of the owner and the over-all health of the animal at the time of entry.

(*c*) To begin with the amount of premium can be fixed only on an arbitrary basis, because there is no data on which any scheme of cattle insurance can be based to suit the conditions of our country and our cattle. As a beginning must be made somewhere and as early as possible it is better to make it in a place where the required data can be made easily available for inaugurating future schemes of cattle insurance and where a Co-operative organisation looking after the interest of the cattle of the cultivators exists. The Coimbatore Union has got a very large area of operation and covers more than half the district. There is every likelihood of extending the area of operation for the whole district in the near future. As this scheme can be considered a pilot-scheme it is just and necessary that both the Provincial and Central Governments should come forward with all the help required to give a fair start to the scheme.

(*d*) As this scheme will come under Accident and Miscellaneous Insurance, a sum of Rs. 1,50,000 will have to be invested in Government Securities and these securities must be deposited with the Reserve Bank of India. This amount of Rs. 1,50,000 together with Rs. 7,500 for organisation and office expenses for each year will have to be given by the Government as a free grant to the Society. The Government must also undertake to pay the Society 75% of the premia payable on the insurance of cattle and also 75% of the claims that the Society will have to meet in the first ten years. This will result in the creation of a Reserve Fund which will be equal to the premia received, less 25% of the claims and other expenses of the society during the first 10 years. At the end of this period the society will be in a position to work out the exact amount of the premia that may be necessary to be paid to meet the claims, to cover the running expenses and to put by a portion of the premium income in the Reserve Fund.

(*e*) The amount covering the risk on an animal need not and should not be its full value. It may be fixed by a Committee of experts at 70% of the probable maximum market value of the animal. The animal will be under insurance for the entire period from its entry after the age of 3 years to the completion of the age of 10 years, provided the contract is kept in force by payment of renewals on a presumptive actuarial basis. For example, the total premium payable on an young animal valued at Rs. 250 will be Rs. 16 in all, of which Rs. 4 will be paid by the Cattle owner, if the animal is under insurance for 8 years. If the animal dies, the owner will get the full 100 rupees risk on the animal of which Rs. 75 will be borne by Government. The younger the animal the lower will be the premium as the risk will be greater in the case of older animals.

(*f*) If all the 5,000 animals come under this scheme, the annual premium income will be about Rs. 15,000. The premium payments by members of the Milk Societies may be made compulsory under the bye-laws and the amount collected from the milk money. The average value of an animal will range from Rs. 150 to Rs. 400 but the number of animals approaching the maximum limit in value is not expected to exceed 1,000. The average value of the animal may therefore be estimated at about Rs. 260. Thus the maximum premium payable on such an animal will be only Rs. 24, of which the owner will bear Rs. 6 only. If by mishap, the animal dies, the owner will get Rs. 200. This will be a great inducement for the agriculturist and individual cattle owners to keep better type of cattle as the risk involved will be considerably reduced

(g) In the scheme as outlined above the commitment to Government will be to the extent of about Rs. 5,37,500 for running the scheme for 10 years. This will comprise a non-recurring grant of Rs. 1,50,000 for starting the scheme, and the recurring expenditure Rs. 3,87,500 which will include Rs. 7,500 for Office and organisation, Rs. 11,250 on the premium payments and about Rs. 20,000 towards 75% of the claim amount, on the basis that about 120 to 150 animals may die in a year. Looking to the benefits which are expected to accrue from such a scheme to the agriculturist the amount is mere nothing, and if the enthusiasm displayed by the members of the Milk Societies of the Coimbatore Milk Union at the time the preliminary enquiries relating to the scheme were carried out, is any criterion, the success of the scheme is assured. A pilot scheme of this nature will provide invaluable data and experience which will come useful for the introduction of such schemes in other parts of the country.

Expenditure Involved.

4. The details of establishment and other expenditure involved in the above scheme are as follows :—

		First Year.
Manager ..	Rs. 125–25–200	Rs. 1,500
Technical officer ..	Rs. 100–10–150	,, 1,200
Accountant ..	Rs. 75– 5–100	,, 900
Typist-Clerk ..	Rs. 60– 3–75	,, 720
Peon ..	Rs. 25– 2–35	,, 300
Agency Commission @ 6¼%		,, 1,000
		,, 5,620
Postage stationery, books and forms		,, 800
Travelling of Manager and Doctor		,, 1,080
	Total Rs.	7,500

Annexure A.

Annual premium payable on each animal to assure the payment of 70% of the value of the animal, in case of death.

Rate of premium on every hundred rupees of risk on an animal. The risk on an animal is only 70% of the value of the animal at the age of entry.

Age of the animal.	Promium on every Rs. 100/-
3 ..	.. 1–13–0
4 ..	.. 1–14–0
5 ..	.. 1–15–0
6 ..	.. 2—0–0
7 ..	.. 2—1–0
8 ..	.. 2—2–0
9 ..	.. 2—4–0

The table is governed by the following rules :—

(i) No portion of the premium is refundable on any account.

(ii) The value of the animal will be certified in the form prescribed for it by a competent authority working with the Society.

(*iii*) The authority nominated by the Society shall also certify to the good health of the animal to be insured. The owners of animals must allow these animals to be protected from infectious diseases by a person authorised to do this work, but they will not be charged for the same.

(*iv*) One month's time will be allowed for payment of renewal premium, but the premium will be payable in advance.

(*v*) The risk undertaken will be for sums of multiples of twenty five, and the value of risk on an animal will be for the nearest such sum and not on the actual calculated 70% of the value of the animal. The rules must be so simplified as to be easily understandable by the villagers and illiterate persons. The lowest risk value will be Rs. 100. This will eliminate all lower-valued and ill-bred animals coming under the scheme.

(*vi*) The rate of premium for every one hundred rupees of risk is given in the Table. For increased amount of risk the premium to be paid will be directly proportionate to that amount.

APPENDIX III (4)

HORMONE THERAPY FOR INCREASING MILK PRODUCTION IN INDIGENOUS STOCK.

(*a*) Dr. P. Bhattacharya, Izatnagar.

For any single country in the world, the size of the cattle population is the largest in India; the total output of milk is no mean either, its volume is second only to that of United States of America. The imposing numerical size and the volume of total output become, however, of little significance when one attempts to look at these from a more realistic angle. An average Indian cow in this country yields hardly more than 600 lb. in a lactation period. Cows of the best milk breeds under farm conditions give about 4,000 lb., whereas in some of the Western countries the average milk yield comes in the region of 10,000 lb. The seemingly large total output when set against—availability per day per capita of human population—turns out to be hardly 7 ozs. as compared to 39 ozs. in United Kingdom. In view of the fact that in the dietary of vast majority of Indians, milk and milk products alone constitute the source of first class protein of animal origin, the position of milk supply is very deplorable indeed. The nutritionist find that the supply falls far short of the requirement and the situation can be redeemed only when the present output is increased by three or even four fold. The task of augmenting milk production apparently is a problem of first magnitude.

During the past century the figure for human population in India has assumed an enormous size. This inordinate population pressure has necessitated the large production of primary foods and these in their turn has called forth large mobilisation of motive power for agricultural production. As the source of power supply for Indian agriculture is mainly cattle labour, the interest in stock has inevitably shifted from milk production to one of work production. The stock-owners were driven to look more for draught than for milk quality. This shift in interest together with the deterioration of environmental condition, particularly in nutrition during the intervening period, has made the complex problem more complicated.

MEANS OF AUGMENTING MILK PRODUCTION IN INDIA.

It has become imperative now that due attention should be given to improve the milk capacity of Indian cattle and all possible avenues should be explored for its realisation.

The fonowing are the possible means by which the milk yield can be increased

(1) By improvement in the genetical make up for milk characters. This can be done by selective breeding and if necessary, by introduction of better 'milk' genes from foreign breeds.

(2) By improving conditions for feeding and management.

(3) Directly, by induction and/or augmentation of lactation in heifers and cows by hormone therapy.

(4) Indirectly, by raising fertility by hormone treatment which ultimately will enable increase in milk production.

The first one is a time consuming process and it will take years before any appreciable result can be obtained. The second is rather a difficult problem and is interrelated with various other factors and cannot be taken isolatedly. The third and the fourth experiences, if effective, are likely to give immediate results and might ease the acute condition of milk shortage.

PRESENT STATUS OF HORMONE THERAPY.

In this note the present status of hormone therapy in increasing milk production is being outlined. It is hoped that this may form the basis of discussion in this committee as to how far the hormonal treatment to Indian Livestock is likely to prove effective in increasing the milk production.

Although the exact mechanism of endocrine control of development of the mammary glands and initiation and maintenance of lactation is not yet clear, it has been well established that in normal animals the oestrogen alone or in combination with progesterone brings about mammary development by stimulating the secretion of mammogenic duct-growth-hormone and mammogenic lobule-alveolar-growth hormone of the anterior-pituitary. The initiation and continuance of milk secretion is caused by the lactogenic hormone (prolactin) of the anterior pituitary. That part of the lactogenic hormone which only initiates lactation is known as lactogen and the other factor which enhances the already established lactation is known as the Galactopoietic factor. The thyroid and the adrenals have also been found to be connected to some extent to lactation. Although the reports on the effects of thyroidectomy in lactating cows are conflicting, there is better agreement about the fact that administration of thyroid and thyroxin to intact animals effects an increase in milk secretion. The adrenal cortex hormone is also stated to be necessary for lactation as ablation of the adrenals prevents normal milk secretion.

DIRECT METHOD OF HORMONE THERAPY.

Use of Anterior Pituitary Extracts.

Experiments carried out in England, America and other countries on laboratory animals as well as on cattle, sheep and goats have definitely indicated that it is possible to increase the milk secretion by the administration of Anterior Pituitary extracts. Various workers produced significant rise in milk secretion as much as 25 to 50% by injecting crude anterior pituitary extracts in lactating cows. Some cows, however, did not respond at all. In others the effect was of temporary nature and became evident only during the downward trend of lactation. Evidences were not lacking, however, which showed that injections were more effective during the rising phase of lactation. There are recorded cases also where the treatment had brought about depression in milk yield.

Stimulation of lactation by anterior pituitary extracts have also been reported in sheep and goats.

Administration of thyroid or thyroxin.

There is general agreement that administration of thyroid or thyroxin effects increased milk production. As a result of injection of thyroxin or oral administration of desiccated thyroid to cows, several workers have reported increased milk production accompanied by appreciable increase in milk fat and non-fatty solids.

Use of oestrogens.

In early experiments, administration of oestrogens to lactating cows also demonstrated beneficial results. It produced increased output of milk solids, although with a slight decrease in yield.

Use of synthetic oestrogens.

High cost and limited supply of the various hormone preparations restricted the use of hormone therapy for increasing milk production to academic interest. The discovery of synthetic oestrogens like diethylstilboestrol which can be produced very cheaply, and the finding that it can induce lactation even in virgin animals aroused wide interest in the possibility of artificial induction of lactation for practical dairy purposes. In recent years milk secretion has been induced in virgin goats by injections and also by injunction of stilboestrol in the udder. In America 100-200 c.c. of milk were obtained from 2 female kids and 500-600 c.c. from two yearling goats. In England by injunction method upto 2 lb., of milk per day were obtained from a virgin goat for a period of 28 weeks.

During the last five years, extensive trials with synthetic oestrogens have been carried out in England and America on virgin heifers and barren cows. The milk secretion varied from negligible quantity to a peak daily yield of 34 lb. In one case administration of a total of 273 mg. of stilboestrol-dipropionate over a fourteen-week period produced 8,046 lb. of milk and 383 lb. of butterfat in 305 days, out of a 33 month-old barren heifer.

In one set of experiments in England with 30 nulliparous heifers, barren cows and free-martins subcutaneous implantation of a total of 2·5 to 5 gm. of diethylstilboes into each resulted in widely different degrees of milk secretion. The lactation curve in some cases were comparable to normal lactations. The best response was obtained in a dry cow which gave a total yield of 740 gallons with a peak yield of 3 gallons daily. In another series of experiments with about 60 heifers and cows, the yield of milk in the majority of heifers approached what might have been expected in a first lactation. A study with as many as 140 cows and heifers treated with tablet implants of stilboestrol or hexoestrol showed a production of over 130 tons of milk, even with incomplete milk record. Some of these animals gave commercial yields.

In an exploratory experiments carried out at Izatnagar, 884½ lb. of milk have been obtained from a nulliparous Hariana heifer in 162 days by stilboestrol treatment the peak of daily milk yield being 5 lb. 3 oz. Another sterile cow gave 1,245 lb. of milk in 209 days as against 2,910 lb. in 307 days of previous lactation.

Considerable amount of work has already been done and is still in progress with regard to the most effective method of administration of synthetic oestrogens. Some workers have found subcutaneous implantation of tablets to be more effective than parenteral or oral administration of the hormone. Others have found that simultaneous injection of a slowly acting and a rapidly acting ester gave better results. There is still controversy of opinion on the point.

The stilboestrol treatment in most cases was accompanied by ovarian hypoplasia and nymphomaniac syndrome and sometimes caused pelvic fracture.

Although oestrogens induce milk secretion in nulliparous heifers and cows they will not augment lactation in lactating cows. According to some workers oestrogenic induction of lactation should not be attempted on heifers which are intended to get in calf in future as it is likely to produce some reproductive disorders. As against this, there is evidence that a large proportion of heifers with normal ovaries which had failed to get in calf before became pregnant after silboestrol treatment..

Use of iodinated casein.

The scarcity and the heavy expenses involved in the large scale use of thyroxine have been greatly solved by the finding that iodinated casein possesses activity similar to the natural hormone. An average increase of 10·5% with a maximum of 41% milk yield has been reported to be produced in goats by feeding 5 to 10 gm. of iodinated casein daily.

In cows by feeding iodinated casein during the middle and latter part of lactation milk yields have been substantially increased by English and American workers. The optimum dose suggested by experiments in England is one which produces augmentation of milk secretion by approximately 20% without producing hyperthyroidism and loss of weight. It should, however, be understood that the artificial increase in yield must be supported *pari passu* by the supply of additional food. In England and Wales extensive trials have been carried out on commercial herds to determine the practicability of treatment of cows in mid-lactation during the later winter months with iodinated casein. A mean increase of 22·2% in daily yield was obtained. On an average the increase in milk production was approximately 250 lb. per cow. Five hundred and thirty eight cows, each given a constant dose of 20 gm. of iodinated casein produced an increase of 100,000 lb. of milk. From a study of the record, it has been suggested that iodinated casein could be used as a practical measure(*a*) if fed to selected cows for periods upto 2 months in later winter (*b*) it should only be used on those farms, where greater production could not be obtained by increase in the efficiency of management, disease control and by better feeding, and (*c*) heifers should not be treated unless well grown, nor those cows which are late in lactation and still giving a yield of 2 gallons. The treatment with iodinated casein has been found to be an economic proposition under the current price of milk in England and Wales during the war-time. Indiscriminate feeding of iodinated casein is frought with the danger of rapid development of hyperthyroidism and the train of disaster that follows at its wake.

Whether or not artificial induction of lactation will be desirable in normal dairy practice is yet to be determined. However, it seems to have a definite promise in dealing with sterile heifers and cows.

INDIRECT METHOD OF HORMONE THERAPY.

Losses due to impaired fertility.

Sterility or impaired fertility is indirectly responsible for a huge loss in the quantity of milk. It has been calculated that in Great Britain losses from sterility in cattle is equivalent to £. 7,000,000 in milk alone. An enquiry into the various causes of wastage in dairy herd made at the National Institute of Dairying some years ago showed that sterility is responsible for 26·17 per cent of the total loss and amongst all the causes it happens to be one at the top. In another investigation carried out in 1940, in three Shires of England the disposal in dairy herds due to sterility was found to be about 23%. It was estimated in Germany before the war that about 15% of the entire breeding stock were treated annually for sterility. Enquiries in other countries have also shown similar high figures for losses due to reproductive failure. Statistics regarding sterility in cattle in India are not available and the

monetary loss which this scourge produces is difficult to assess. It must obviously be very heavy. It is a common knowledge now that cattle in India are often low in coming into oestrus and the inter-calving period on an average is very long. A vast majority of the cows in this country do not calve every year as in other countries but on alternate years or even once in three years. If a fraction of these sterile cattle can be made to get in calves, and if the inter-calving period could be telescoped, the return in the shape of milk will be enormous.

Sterility may be due to various factors such as nutritional deficiencies, genetical pathological conditions and endocrine disfunctions. In this discussion we are concerned with functional sterility only. Extensive work has been done in various countries on the use of hormone therapy for threatening sterility of endocrinal origin and also controlling the reproductive process and there is now indication that it can be used with great advantage.

Use of gonadotropic and oestrogenic hormones in combating sterility.

Endocrinal disfunction in cows may be evinced by anaphrodasia or absence of heat, nymphonia, or failure to conceive following service even though the oestrous cycle is regular. Oestrus and ovulation have been induced by administration of Pregenancy Urine (Human), Pregnant Mare Serum, Anterior Pituitary Extracts and both synthetic and natural oestrogens. Opinion differs as to which of these products is most effective. In an experiment carried out at Cambridge by the author 15 cows were treated with varying dosage of Anterior Pituitary Extracts and Pregnant Mare Serum. Pregnancies were produced in as many as twelve, some of which gave birth to twins and triplets. A large number of cows were slaughtered after treatment with Pregnant Mare Serum and Anterior Pituitary Extracts and found to have ovulated and in some cases fertilised ova or embryos were recovered. In an experiment in Russia a few years ago 35 cows were treated with Pregnant Mare Serum out of which five became pregnant and subsequently calved. In an attempt made at Izatnagar to shorten the interior-calving period in cattle, 18 cows and 2 buffaloes which did not show any signs of heat for a considerable period after the last calving have been treated with pregnant Mare Serum in which 7 pregnancies have been produced and another 3 animals are suspected to be pregnant at the time of writing this note. Besides these, four other treated animals were subsequently killed and it was found that ovulation had taken place in two. The work is being continued. It has been mentioned in a monograph recently published by a pioneer Russian worker that 90% of the cows treated with Pregnant Mare Serum, became pregnant. The author states that, " The economic effect of administration of pregnant Mare Serum is chiefly due to the shortening, by at least a cycle, of the service period. This alone would enable an additional 100,000 calves per million cows to be obtained ". The above statement lends support to the undertaking of large scale test of the physiological and economical efficiency of Pregnant Mare Serum in Indian cattle.

In the other two conditions viz., nymphomania and failure to conceive even when the oestrous cycle is regular, Pregnancy Urine Extract has been used with success by some.

Indiscriminate use of hormone therapy for the treatment of reproductive failure may cause various complications like cystic ovaries, abortion and multiple births etc. Mass practice of hormone therapy in reproductive failure is circumscribed by the fact that it entails on the part of its users specialised knowledge of physiology and anatomy of reproductive organs.

HORMONE THERAPY IN ITS APPLICATION TO INDIAN LIVESTOCK.

From the above brief review of researches and practical investigations carried out on the application of hormones in augmenting milk production, it is safe to conclude that both direct and indirect therapy have opened up definite economic possibilities. It may, however again be emphasized that both the methods involve adoptation of delicate technique. They demand of the users a store of biological knowledge which an ordinary stockman cannot possess. The hormones or hormonelike products will remain imported articles in India for some considerable time. The prices, therefore, will be prohibitive.

In the present state of Dairy Husbandry in India, very careful consideration should be given before the direct method is taken up as a practical expendience on any mass scale. Perhaps the greatest hurdle that will stand in its general use is the higher level of nutrition the treated animals would inevitably require. The present supply of feeds and fodder is now well known to be insufficient even to maintain the stock population. Moreover, whatever available is also known to be qualitatively very poor. Unless, therefore, the feed-and-fodder front is properly safeguarded, any practical application of relatively cheap hormone-like synthetics would not only be of no avail but may lead to fatal pitfalls of functional and deficiency diseases. These words of caution, however, do not mean that this progressive research should be accorded a close-door in India. It would, on the contrary profit in the end if we fall in with the workers abroad and supplement our knowledge. Besides, inspite of the general handicap there are in India a number of progressive farms where the research experiences can be translated into actual practice.

The use of the indirect method has immediate and greater possibility in India. But much more knowledge than hitherto gathered is required before its application can be made safe and widespread. Time has surely come when we should take up the cue from other countries and launch our own under the varied and peculiar conditions prevailing in India.

RECOMMENDATIONS.

On the basis of the above review the following recommendations are made for the future line of research and field investigations which may be taken up in India.

1. Investigation into the possibility of using synthetic oestrogens and iodinated casein in augmenting milk production should be under taken immediately in some research centre and selected progressive farms.

2. Studies on the lactational endocrinology in Indian dairy animals should be initiated as soon as possible.

3. A survey of the incidence of sterility in Indian dairy animals be made to determine its causes and the frequency of the various causal groups.

4. Possibility of hormone therapy in functional sterility in dairy animals should be explored on a wide scale.

5. A refresher course be introduced at the Imperial Veterinary Research Institute for the officers who are to undertake the work on hormone therapy for inducing increased fertility in dairy animals.

APPENDIX III (4)

(b) Dr. T. W. Millen, M.Sc., D.V.M., Agricultural Institute, Allahabad.

In many dairy herds in India there are unproductive females. Some are heifers that will not freshen until they are five or six years old. Others are dry cows that

fail to come in heat. A third group come in heat regularly but fail to conceive. In this paper we will deal with means of over coming sexual inertia in dairy cattle and the use of lactogenic hormones to increase milk production but will not discuss possible causes of the sterility of those cows which fail to settle. Some hormone therapy has helped in these cases also but we have not made much progress with this group.

We must consider the pro uction of the cows on an annual basis. Long lactations are not economical, long d y periods are even less so. A herd with a high overall average is usually one in which 25% or less of the cows are dry. In our herd we aim at lactations of 300 days and dry period of 60 days giving us a calving interval of one year. An annual lactation of 1,465 pounds of milk paid for feed only for one of our cows last year. A yield of 2,000 pounds paid for feed, labour and other expenses but left no profit and paid nothing towards replacement. We need an overall daily average of nearly 9 pounds or an annual yield of 3,250 pounds per cow in our herd to pay all expenses replace the cow in 6 years and have 10% on our investment. Our 18 Red Sindhis completing lacrations last year had an overall daily average of 5·75 pounds and an average annual yield of 2,096 pounds. Their lactations averaged 3,005 pounds but the average preceeding dry period of the cows was too long, 214·8 days. One daughter of our late Sindh Queen will have her first calf in December at the age of six years. Her younger sister gave out best yield for a Red Sindhi last year. We are doing what we can by selection and line breeding to improve our stock but we find hormone therapy offers considerable help.

Let us take a bird's eye view of the normal physiological functioning of the hormones or reproduction. An anterior pituitary hormone (Prolan) A stimulates the ovary initiating the development of a follicle. The developing felicle then begins hormone production (theelin) which reaches a peak at the time of oestrum. The effect on the reproductive tract and the disposition of the cow is easily seen. Whether or not successful mating takes place a corpus luteum develops in the ruptured follicle. An anterior pituitary hormone Prolan B, helps with the follicle rupture and development of the corpus luteum. The hormone from the "yellow body" (progestin) remains in control until the termination of pregnancy. If the animal has not successfully rated this temporary endocrine gland gradually degenerates. Only after sufficient degeneration of the corpus luteum will a new follicle ripen and oestrum recur. In the unbred animal this cycle is repeated at intervals of about 21 days.

We are not concerned in this paper with all the theories behind why these hormones behave this way. Whether the corpus luteum neutralizes the anterior pituitary follicle stimulating hormone, (prolan A), whether it utilizes all of it denying any to the follicle or by what other manner this result is accomplished we have no proof. We do know that natural and synthetic hormones can be used to alter the normal routine under certain conditions and we know that in dairy cattle the reproductive regularity is closely associated with milk yiel .

The secretion of milk itself is associated with hormones secreted in the sam glands that direct the reproductive cycle. These may be summarized as follows:—

GLAND	HORMONE	ACTION
Anterior Pituitary	Thyrotrpic	Thyroid gland activity
Anterior Pituitary	Lactogenic "Prolaction or galactin"	Mammary gland actual milk secretion.
Ovarian follicle	Oestrone	Initial budding and growth of the mammae.
Corpus Luteum	Progesterone	Duct development and alveolaror secretory portion of mammary gland.
Thyroid	Thyroxin	Growth, sexual maturity higher metabolic rate. Increased milk and fat production.

Both oestrone and progesterone are closely related chemically as they are both stevols. Hormones are carried in the blood from the gland in which they are made to the organ which they act upon. In U.S.A. blood serum of pregnant mares is concentrated and standardized as to its hormone content and sold under the trade name " Gonadin ". The first morning urine of pregnant women is collected in certain cities for its oestrogenic hormone. This urine is detoxified and the hormone fraction is separated out and concentrated. This product is known as " theelol " and is a triatomic alcohol. These two products Gonadin and theelol are used considerably in veterinary practice in U.S.A.

A survey has been duly conducted to determine the number of non-breeding cows in Government and certain private herds here in India. I have not seen the result.

Pregnant mare serum was promised us but so far as I know is not yet available. In December 1944 experimentation in its production was under way and results were reported as encouraging.

Case reports and summary of work at the Allahabad Agricultural Institute.

Corpus Luteum removal.

We began routine removal of the corpus luteum on slow breeders in December, 1943. Our practice is to wait four to five months after calving and if the cow does not come in heat normally she is examined rectally. A persistant corpus luteum is removed and follicular cysts are ruptured. In most cases the cows come in heat within three weeks, of treatment. In some cases a second corpus luteum is developed which must be removed. When possible we examine these unbred cows at monthly intervals. Of the first 28 examined (23 cows and 5 buffaloes) 17 responded readily. Our list each month now is very small. We examined cows in several other herds and found some corpora lutea but in many nonbreeding animals the ovaries were very much enlarged or were small and inactive.

We purchased 12 red Sindhi cows with calves in Karachi in February 1946. By May 18th six had been bred and six had not been in oestrum. Five of these had corpora lutea and the sixth a small cyst. One was bred two days after removal of the corpus luteum and a second 26 days after the removal.

Pregnant Mare Serum.

We purchased a pregnant mare and pregnant donkey to experiment further with the cows and older heifers revealing infantile ovaries or large unresponsive ovaries. This work began in August, 1944. We tried to make clear serum but owing to lack of facilities decided to use citrated blood. We injected a number of virgin heifers both cows and buffaloes, as well as non-breeding cows and buffaloes. No harmful effects were noted whether we used horse blood and then donkey blood, or whether the same species blood each time or whether the blood was mixed. We were unable to find any literature which gave us any indication as dosage. We were using the two dose methods, at an interval of two weeks, similar to that recommended for "gonadin" but our product had not been standardized or concentrated. We had some response, several animals came in heat but we soon abandoned this work when we secured samples of " Stilboestrol " .

Stilboestrol.

This is a synthetic estrogenic hormone that has recently become available. We tried several brands but as " Clinestrol " put up the Glaxo laboratories Ltd., was most

readily available we used this product almost exclusively. The 1. mg. tablet in bottles of 25 are stocked by most chemists. We ground them up with a mixture of normal saline and sterile sesame (til or sweet) oil and injected them subcutaneously in the neck of the cow or heifer.

One aged cow began giving milk within 48 hours although she had been dry for more than three years. Heifers that aborted at 5 to 6 months of pregnancy produced milk after two or three injections. Virgin heifers began considerable under development after two or three injections. Many of the virgin heifers came in heat. A number of cattle owners here in Allahabad have fed these tablets to slow maturing heifers and to dry cows and buffaloes with apparently successful results. We have not had the same success with the oral administration of the drug or with the Stilboestrol Dipropionate, which is ready for injection, that we secured with the subcutaneous injection of the tablets crushed in oil.

We were more than pleased with the results of the use of Clinestrol as most of our animals responded readily. Soon most of the treated animals were bred. One Nymphomaniac from which we had ruptured cysts repeatedly produced corpora lutea in both ovaries. These were removed and she came in heat and was bred. We had great hopes for the new drug. In time however we found out that the action of the drug is not so simple. Many animals that we thought were pregnant were carrying persistant corpora lutea but not foeti. After removal of these corpora lutea oestrous cycles are usually restored. We now examine all treated cows and heifers for pregnancy four months after breeding.

An example to show the necessity of rectal palpation following treatment is the case of cow No. 484. She was born in November 1936. Her last calf was born on 20-9-44 and she had still not manifest oestrum by May 1945. Her ovaries appeared to be large but inactive on palpation on May 26th. Injections of 5 mg. of stilboestrol twice a week were commenced on 7-7-45. Four injections were given, the last on 17-7-45. Her ovaries appeared normal on examination three days later but she did not come in oestrum during the next two months. On 19-9-45 a corpus luteum was removed from the left ovary. Three days later the cow came in oestrum and was bred. Her calf was born in July 46. Other similar cases have occurred where instead of oestrum resulting from stilboestrol injection, corpora lutea are formed which must be removed before the oestrous cycle can be re-established.

Few cows and heifers conceived at the first induced oestrum. They apparently have not ripened ova, instead the injected hormone is responsible for the symptoms of oestrum. Usually they conceive at the next oestrum. Heifers 788 born on 12-7-42 was one of the first we treated with stilboestrol. Three injections of 5 mg. each were given the first on 26-5-45 and the third on 2-6-45. Two days following the third injection she was bred. Oestrum occurred again on 9-7-45 when conception resulted. Her calf was born 13-4-46. Heifer 823 born on 31-1-43 received seven injections of 5 mg. each commencing on 23-6-45 and ending on 14-7-45. She was in oestrum and was bred on 15-7-45. Again on 15-8-45 she was again in oestrum and was mated to the same bull. Her calf was born on 8-6-46. In these cases the second oestrum was 35 and 31 days respectively after the induced oestrum.

Iodoprotein.

Most of our slow maturing heifers have been slow-growing also. Our red Sindhi heifers are smaller as two year older than Jersey-Sindhi crossbreds. Both groups weigh almost the same at calving but the red Sindhi are about one and one half year older. We are now using home made iodoprotein to stimulate growth and sexual

maturity in slow maturing heifers. Mr. K. Das Gupta, our dairy supervisor, has prepared and administered most of the product and is carring on the experiment.

We use fresh separated milk and iodine stock solution to make up each days requirements. The milk mixture can be kept up to three days without refrigeration but we usually make it fresh daily. The product contains 2·8 grams of potassium iodide. 1·5 grams of iodine and 75 c.c. of water to each 10·00 cc of separated milk. We add sodium carborate to adjust the PH to 6·8—7·0 and combine the iodine with the casein using heat.

We use the whole solution instead of concentrating the iodoprotein. To the young heifers we give 100 c.c. daily for two weeks, then wait two weeks before repeating the procedure. The iodine content is high but it is all combined with casein and we have not been able to detect any iodism in the treated animals. The solution in the concentrated feed if the animals are fed individually. One heifer in the first group treated came in oestrum and was bred before the first two weeks were over. The heifers continued a good rate of growth during the two weeks they were not under treatment.

Although Stilboestiol has been used to secure milk from virgin heifers in England and America the hormone which has given best results in increasing milk and butter fat production has been thyropine. The effect does not last long as the hormone is used up quitely. Thyropine is expensive but the cheaper iodinated proteins give similar results, undoubtedly being changed to thyropine in the animal body.

We used daily dose of 450 cc per cow over a two week period on cows yielding 1·8 and 6·9 pounds daily. By the end of the second week production had increased to 2·8 pounds and 8·5 pounds respectively or an increase of 55·6% and 23·2%. Butter fat per cent also increased from 5·5 to 6·7 and 5·6 to 7·0 respectively. When iodinated protein feeding was stopped the milk production dropped gradually so that at the end of the second week of treatment it was almost the same, as before the feeding began. Production increased again as soon as the iodinated casein was again fed. The cost of each daily dose was about 3 annas. If the wholesale price of milk is 8 pounds to the rupee an increase of 1½ pounds of milk would just pay for the added cost.

We have so far confined our experiment to low yielding animals toward the end of their lactation and determine whether our product would show the presence of an active thyropine like substance and to determine whether any undesirable effects would result from this high rate of iodine feeding. We are satisfied with the product and believe a combination of iodinated protein and stilbestrol will help us in securing earlier maturity and higher lactations from indigenous cows. Further experimentation is in progress.

The cows must be fed well during the time their metabolic rate has been stepped up or they will lose weight. We estimated our dosages as 14 grams of iodinated casein per day. Further experimentation is necessary to determine whether this is the optimum dosage or not. Supplementary concentrates must be given or the increased milk and butter fat are gained from the cows body. Experimentation is necessary to determine the kind the quantity to be given. The cows pick up weight when the treatment is stopped.

Recommendations.

1. The determination of pregnancy by rectal palpation and the removal of corpora lutea should be taught to all veterinary students, and believe this instruction is not given in any of the veterinary college in India.

2. All dairy cows should be served again three months after parturation so that the calving interval is as near 12 months as possible. Those not showing oestrum at the end of four months should be examined and treated by a qualified veterinarian.

3. Cows and heifers showing large firm ovaries or small in-active ovaries may be given twice weekly injections of stilbestrol. The dose recommended is 3 mg with a maximum of five or six doses. Examination and removal of corpora lutea should follow the treatment if the cows or heifers do not respond within three weeks of the completion of the injection.

4. All cows and heifers bred after hormone treatment should be examined for pregnancy by the end of the fourth month.

5. Iodinated casein can be made cheaply for daily use. It may be fed by growing heifers to increase their rate of growth and maturity suggested dosage is three grams of iodinated protein for two years old heifers.

6. Iodinated protein may be given to lactating cows provided they are in good flesh and are fed extra concentrates to offset the issue in their metabolic rate. This might best be used after the cows have passed their peak yield in the lactation about the third or fourth month.

7. Prolonging lactations are producing lactations in virgin animals by the use of hormone are possible but uneconomical.

8. Provincial and state governments might profitably sponser controlled experiments in the use of hormone therapy and make estrogenic and lactogenic hormone available to their veterinary personnel.

9. Iodine solutions with directions for the preparation and use of iodinated casein can be supplied to selected dairies where records are available. In a short time the possibilities of this substance in field use can be determined.

10. Hormones are potent substances and many physiological functions are controlled by them. Control measures are necessary to prevent unscrupulous exploitation of them to the detriment of our dairy animals.

11. Hormone therapy is a temporary measure for increased milk production in indigenous stock. Early maturity regular annual calving and persistant lactation should be introduced into the breeding herd and maintained by selection.

APPENDIX III (4)

(c) Abdul Wahid Khan, Assistant Superintendent— Government Livestock Farm, Hissar.

Milk industry in an Agricultural Country like India where the major portion of the population use milk and its various products which are indispensible for perfect health, is of vast importance. The milk in this country is generally supplied by cows, buffaloes and to a very limited extent by goats as shown below :—

Cows	54·7%
Buffaloes	43·6%
Goats	1·6%
Others	0·1%

(Dr. Wright report, page 146).

The number of these milch animals in this country is quite large being 32% of the whole of Indian Cattle population, but inspite of this the total production and consumption of milk as compared with some of the western countries is deplorably

low. The average milk yield of village Indian cow varies from 525 to 945 lbs. as against 5,576 lbs. of Great Britain, 4,126 lbs. of U. S. A. and 7,005 lbs. of Danish cows. This shows that Indian cows are not efficient milk producing machines. The same holds good for goats as the average milk yield in goats is 490 lbs. as compared with 2,634 lbs. of Great Britain (as quoted by Watkin).

For sometime past, the question which has been mainly exercising the minds of the leading stockmen of our country is, as to how to improve the milk yielding qualities of our cattle. It has been felt that such an improvement is urgent both in quantity and in quality otherwise the price of milk will remain high, thus debarring the poor people to take the full benefit of this vital article of food. At present this object is being achieved through the advocacy for the maintenance of productive cows and pedigree bulls, comfortable and sanitary byres, good feeding, judicious selection and mating etc. These conditions are, however, difficult to fulfil in all cases and are not always obtainable. Over and above this, the process is rather lengthy, expensive and liable to exhaust the patience of the breeders.

In recent years much useful work has been done on the role of hormones on the initiation, maintenance and inhibition of lactation. There is probably no single measure which would prove more helpful in increasing and cheapening the milk production in the shortest possible time than the application of hormone therapy on a larger scale. This, however, has not so far been tried on any appreciable scale in India. Sufficient work has, however, been done and published by scientists of Great Britain and U. S. A. They have studied the role of hormones on the initiation and maintenance of lactation. Most of the work has been carried out on small animals like rats and guinea pigs etc. The results achieved on these small animals can easily be applied with slight modification to animals such as cows and goats as the function of endocrine system seems to be fundamentally the same for all mammals.

The hormone therapy has already begun to spread out from the confines of a laboratory and the results obtained are assuming practical importance in some countries. The results obtained in other countries if applied to the indigenous cattle hold a great promise for the future milk development in India. If applied successfully as a general routine, not only the milk yield will be increased, but also the wastage and loss sustained by the cattle owners by keeping barren and low producing animals will be cut down to a certain extent.

Scientific background and results achieved.

Until recently the attention of the workers was centered round the study of the precise nature of the action of oestrin, progesterone and antipituctary lobe extracts upon the development of mammary glands and on lactation generally. From experiments conducted, it was found that oestrin and progesterone both cause the development of mammary glands characteristic of pregnancy while some hormones such as "prolactin" and "galactin" or mamotropin from the anterior lobe of pituitary cause initiation and maintenance of lactation.

Nelson found that injections of pituitary extracts into pregnant guinea pigs induced lactation. From this experiment, he further concluded that various hormones cause growth and development of mammary glands during pregnancy but prevent the secretion of milk by inhibiting the action of the necessary *pituitary factor*. These results were confirmed by Comez, Turner, Lyons and Pencharz, who worked on similar lines on small animals and the results achieved by them were identical to those of Nelson.

Folley with a view to noting the effect of oestrogenic hormones on lactation in cows gave intramuscular injunctions of 50 grms. of oestradiol benzoate and 500 grms. of oestrone over a period of 3 days while another cow was given 15 mg. of the benezote on each 5 consecutive days and found that milk yield fell by about 20% while solids not fat rose by 10% and remained at that level for a long period, after the last injunction, with no change in the fat contents. He confirmed the results already achieved by workers that oestrogenic hormones inhibit milk secretion.

Evans found that prolactin preparations increase the milk yield of cows and goats sometimes by as much as 25—30% of the level immediately preceding the injection. The workers on the basis of above stated experiments detected that it would be quite possible that combined use of oestrin, prolactin or thyroxine may produce a lasting effect on the yield of milk and concentration of its constituents.

Jack and Bechdel worked on the effect of thyroxine on the increase of milk yield in cows in different stages of their lactation cycles and found that increase in the milk yield was greatest during the decline, a few weeks before the end of the lactation period. At the peak, however, the effect was less marked, while at the extreme end it was scarcely significant.

Submit working with the same hormone, on rabbits confirmed the above results and further found that there was not only an increase in the milk yield but also in fat contents.

Herman with an idea to determine the effect of the same hormone (thyroxine) on the secretion of milk in cows fed about 60 grms of dessicated thyroid gland daily to cows after the peak of lactation for about 8 weeks and noticed an average increase of 18% in milk yield and 35% in the butter fat. This treatment, however, had no effect on the height and towards the end of lactation.

In the light of the above findings, Asdell concluded experiments on goats in 1936 and found that prolactin when injected into goats had no effect at the peak of lactation, but increased milk yield late in the lactation. The effect was, however, more marked in the case of *lowest yielding animals*. The goats which responded to the treatment showed only a temporary improvement as they invariably developed into an unusually steep decline in lactation. The effect of this hormone (prolactin) was also studied by Folley and Young on cows whom they gave injections of 1 grm. of their preparation made in water at PH 8, for 15 days and to another cow water alone was given. The hormone caused 30% increase in the milk yield, but the constituents except solids not fat, the level of which rose considerably, remained unaffected.

Azimov who studied the effect of injecting total anterior pituitary preparation in 510 cows of various breeds with 90 as controls found that there was a marked, though temporary, rise in milk yield. The highest yield was, however, obtained 2 days after the injection. Reece while confirming the findings found that the effect was greatest in animals which were well kept and well fed.

Recently extensive work on certain derivatives such as stilbestrols and the biological activities have been carried out by Dodd's on the composition of milk. Waston and Folley did the same work with Diethy-stilbestrol. The action of these resembled with that of 'oestrogens'. This had a further advantage that they are easily available.

In experiments conducted in America on dairy cattle the quantity of hormones used, the duration of treatment, and the mode of administration varied greatly. The quantity of milk secreted varied from negligible amounts to a maximum daily yield of 34 lbs. In a barren Jersey heifer aged 33 months, injection of 273 mgs. of

stilbestrol dipropeonate over a period of 14 weeks resulted in the production of 8046 bs. of milk and 383 butter fat in 305 days. In another 30 months old heifer that failed to conceive on four services, injections of 60 mgs. of testosterone propionate plus 163 mgs. of the ' stilbestrol dipropionate ' over a period of 11 weeks resulted in the production of 6634 lbs. of milk and 251 lbs. butter fat in 346 days with a peak yield of 27·5 lbs. Milking was done only after the injection and not during the period of injections.

In England extensive trials have been carried out with oestrogens in cattle. Implantation of tablets of diethylstilbestrol or hexestrol (2 to 5 gms) in 30 virgin heifers and dry barren cows resulted in wide different degrees of lactation. Daily milk yields were frequently greater than 2 gallons within two months after the start of treatment, while one cow yielded three gallons a day.

In another batch of 60 heifers and cows, tablets of Diethylstilbestrol or Hexestrol (0·4 to 5 gm.) were implanted over 80 to 200 days. In heifers the udder became tense after 4 weeks and milk appeared after 40 days. The milk yield was what might be expected in the 1st lactation. Increase in milk appeared after 40 days. Increase in milk was also noticed on the removal of tablets and on single injection of 200 mg. of diethylstilbestrol in oil in cases where the yield was abnormally low. Baker (1944) reported a case of a 19 months old Aryrshire heifer, which although had normal development had failed to come in heat. In this case 12 daily intramuscular injections with a proprietory brand of diethylstilbestrol dipropionate (total 236 mgs) resulted in the growth of teats and udder and finally initiation of milk on the 12th day. The udder continued to function after the cessation of treatment. Indications however are that estrogen should not be used on a heifer to bring her to milk if you hope to get her with a calf. The continued treatment is likely to cause cystic overies.

Similarly, Folley J. J. and Malpross F. H. (1944) reported a case of a barren cow which as a result of the implantation of stilbestrol tablets yielded from 1 to 30 lbs. daily milk with 6170 lbs. lactation yield.

Their effects be summed up as under :—

1. Oestrone, oestrol, oestradiol and testosterone are inhibitors of lactation, but cause growth and development of the mammary gland. For the inducement of the gland (mammary) testosterone requires the presence of pituitary gland.

2. Progesterone and rosterone do neither.

3. Prolaction, thyroxine, stilbestrol, dipropionate, diethylstilbestrol or hexestrol increase the milk yield.

The results of the investigations carried out by the scientists in other countries in the field of hormonic therapy are highly interesting, miraculous at times and encouraging. They atonce show a way for the solution of the ever worrying question of milk supply of this country. This if proved successful will further lend a help to the already adopted methods of improved breeding and feeding of cattle.

Since most of the Indian milch animals are comparatively low yielders, the use of hormone therapy if adopted on a large scale along with improved methods of breeding and feeding would go a long way in removing the factor of low milk yields. The loss sustained by the cattle owners by keeping barren and unproductive animals would be removed as the barren cows may be made to yield milk as done in other countries. This is all the more important in the country where a great number of such animals is kept due to sentimental reasons.

The results achieved in foreign countries require to be confirmed on Indian Cattle before they are adopted on a large scale on the indigenous stock in commercial dairies. More consistent results are required to be achieved by organizing well controlled experiments in certain Farms and localities as early as possible.

SUBJECT No. IV (1).

A Review of the experiences gained on artificial insemination in India and proposals of means by which the practice can be extended.

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The possibility of breeding animals artificially was demonstrated on a scientific basis as long ago as 1780, but few attempts were made to make use of it until 1907 when its practical potentialities were explored in Russia. Early experiments in Russia were met with such encouraging results that in another two years' time a laboratory was established there to train Veterinarians in artificial insemination technique. Russia was first to employ in large scale artificial insemination in practical husbandry and spectacular success has been achieved in the hundreds of insemination centres which are now functioning there. The lead given by Russia was very slowly followed by other countries, for example, the first insemination centre in U. S. A. was started in 1937. In about the same year Denmark was the first country in Europe (excluding Russia) to attempt large scale application of artificial breeding. Interest in artificial insemination in U. K. during the pre-war days was mainly confined to research and only so lately as in 1942 two artificial insemination centres were started for the first time. In the improvement of livestock industry the importance of artificial method of breeding is now increasingly realised as is evident from the fact that in U. S. A. within 6 years the number of insemination centres has swelled to 99 excluding the affiliated sub-units; in U. K. in two years 6 new centres were established; in Kenya colony, the work was started in 1935 and by 1942 more than 20,000 cows were inseminated annually and since then the number must have increased greatly as further developments have taken place there.

Work done in India.

In India sporadic attempts have been made since 1939 to take up the work but systematic investigations on artificial insemination with special reference to Indian conditions began only in 1942 at the Indian Veterinary Research Institute under a scheme sponsored by the Indian Council of Agricultural Research.

Laboratory Research.—According to the programme of this scheme, studies were made on the suitability of the various techniques developed abroad on collection of semen, its preservation and insemination. These studies have shown that the techniques in broad aspects can be used successfully under Indian conditions. Indian animals can be easily trained to mount even on anoestrous females and to ejaculate into artificial vagina. Bulls of some breeds have, however, been found to be very slow. The semen thus obtained proved to be quite good as regards its sperm density, keeping quality and capacity to impregnate. Various dilutors and preservatives for semen have also been successfully tried.

Cows, buffaloes, ewes and goats have been impregnated with semen preserved for upto, 156, 120, 168, 96 hours respectively and fractions of a single ejaculate upto

1/72nd, 1/12th, 1/40th and 1/32nd have successfully been tried in species in the order mentioned. The percentage of successful impregnation in 1945 46 was 86·4, 70·4, 82·6 and 86·9 respectively in cows, buffaloes, ewes and goats.

Field application of the method.—Colaterally with the laboratory research, work on artificial breeding was extended to the neighbouring villages. Experience so far gained suggests that so far as the technique is concerned there should not be much difficulty in the utilisation of this method in practical animal husbandry of the country. The technique, however, is not all in successfully using the method in a large scale. Its practical application is found to depend largely on organisation. The field work started at Izatnagar indicated the importance of determining how far the various adverse conditions, such as, conservatism of farmers and their prejudice against this unnatural system, lack of knowledge regarding the various reproductive processes in Indian farm animals, negligence on the part of owners to bring their animals for insemination at the right time, difficulties in handling and inseminating many village cows, severe climatic conditions, insanitary surroundings and apalling lack of transport facilities etc., would hinder the application and extension of the use of artificial insemination in this country. In view of this the Government of India sanctioned the establishment of four regional centres in Calcutta Patna, Bangalore and Montgomery to study the problems and gather there from necessary information for the future planning and development of the method. At the time of writing this note, Calcutta, Patna and Montgomery centres have completed about 6 months of work. For lack of trained personnel the Bangalore centre could not yet be started. The Calcutta Centre is working under conditions obtainable in large cities and the other two in more or less rural environments, within this short period 1,183 (figure upto middle of July, 1946) animals have been inseminated in these centres. The number of animals inseminated increased by more than 100% during the second half of this period—a fact which indicates that the system is becoming popular and acceptable to the Indian owners.

At Izatnagar during the past one year 743 animals have been inseminated. The method is becoming increasingly popular. The Agricultural Institute at Naini is also reported to be getting quite a good number of cases for artificial insemination. Recently one sub-unit has been opened at Beliaghata near Calcutta and another at Bareilly. Arrangements have also been made to open two other sub-units at Patna and one at Montgomery immediately. When these sub-units start functioning the number of inseminations at the various centres is expected to increase greatly. The U. P. Government is also about to start a centre at Meerut.

In these centres, one inseminator is posted in each, except in Calcutta and Izatnagar where there are two. The animals to be inseminated are gengerally brought at the inseminating station. Occasionally animals are inseminated at the owner's place. At Izatnagar a man goes round distant villages and collects the animals on heat at a central place for insemination. This field work is still in its early stage of initiation. Notwithstanding the difficulties mentioned above, from the progress made so far, there is sufficient indication of definite promise in the practical application of artificial insemination and its possible development into a dependable system of livestock breeding. By taking a little care in explaining the advantages of the method and also by demonstrating the practical results obtained, the stock-owners can be convinced about the efficacy and harmlessness of the method. It may as well be mentioned here that it has been our experience that a stock-owner is prone to doubt the usefulness of the method when the first animal he brings to the centre fails to get in calf. In most cases the unfertile inseminations are due to reproductive

disorders of the animals. It therefore, becomes incumbent for the officers to examine and wherever necessary, give treatment to such animals. In doubtful cases it is best to forewarn the owners

Transport problem in relation to artificial insemination.—The question of transport difficulties is linked up with the general communication and road development of the country. It is hoped that the post-war development in communication and road may ease the position to some extent. At the present moment wherever there is some sort of a road communication it is not impracticable to operate a centre with a radius of 5—10 miles if the technician is provided with a fast moving vehicle like a motor cycle. The operation will of course be difficult for those parts of the country which remain submerged under water during the rainy season. In regard to transport of semen to distant places researches are in progress to construct a light-weight container which will maintain low temperature required for the preservation and storage of semen during transit. It has been found that ordinary big sized thermos (3 Pints) can be successfully employed for storage and transport for a period of about 3 days. The other difficulties mentioned above are of course there, and these can only be overcome gradually.

The demand of trained personnel and insemination kits.—There are two more difficulties which have not been mentioned before. These are (1) lack of trained personnel and (2) difficulties regarding the availability of necessary outfit and equipments.

To meet the future demands for technicians the Indian Veterinary Research Institute has introduced a short and a very intensive course of practical training and already 5 batches of students from different provinces and states have been trained. These persons will be quite suitable to run insemination units but it is felt necessary to introduce a long term course of training in the science and organisation of artificial insemination to equip personnel for taking charge of big artificial insemination and semen distributing centres and also to supervise and organise the work of the units within their respective zones.

With regard to equipments, arrangements have been made with a firm in Calcutta to manufacture and assemble a complete kit.

Future Development of Artificial Insemination work in India.—The scarcity of suitable breeding sires is now well known. There are few, if any, proved bulls in the country. Even if all the pedigreed and approved bulls are taken into consideration it will not exceed one per-cent of the total requirements. In a situation so circumscribed the only possible means by which the pace can be quickened to improve the present day degenerated stock lies in the application of artificial insemination, a method, which alone can produce pregnancies in a number of females out of a single ejaculate. The condition of livestock in India today is somewhat similar to what it was in Russia at the end of the first world war. But by widespread application of artificial breeding it was possible there to build up large herd of improved stock within a relatively short period.

In view of the above it would be advisable to explore without any loss of time all possible avenues to make the utmost use of this method in this country despite the difficulties prevailing at the moment. It will, of course, be necessary to proceed very cautiously and the development should be made under carefully controlled conditions. Every attempt must be made to avoid pitfalls which might lead to disappointment and monetary loss and bring this useful system into general disrepute.

Organisation and suggestion of its lines of development.—In Russia collective organisation and state control of agriculture have been responsible for the quick and

successful development of the practice of artificial insemination. In U. K. artificial insemination has been developed as a national service, the centres being run by organizations such as, Cattle Breeding Societies, Farmers' Co-operative Societies and the Milk Marketing Board. In almost all other countries where this system has been practiced on a large scale, organizations have been made mainly on co-operative basis. In U. S. A., almost all the artificial insemination societies receive some sort of assistance from the Government or the State Universities in the form of bulls on hire at nominal rates. Besides, the Dairy Extension Division of State Universities, give help in the form of publicity, clerical assistance and general supervision. In India, however, it is difficult to organise the practice on co-operative basis and the organisation, at the outset, will have to be sponsored entirely by the Government.

A tentative suggestion regarding the immediate plan of development is made below for consideration of the committee :—

1. Artificial insemination should be introduced in all Government Farms and Dairies. The work done at these places will act as an incentive to private stock-owners and it will also help in releasing breeding sires for use in other places. It may also be introduced in all Milk Recording Schemes of the Indian Council of Agricultural Research and in all Pinjrapoles and Gowsallas.

2. Insemination may be started in selected Veterinary Hospitals, as well as, at places where livestock officers have been employed. The Veterinary Hospitals have been suggested as these are already provided with various equipments which are also required for artificial insemination work and thus the initial outlay can be minimised greatly. Quite a number of hospitals in the provinces also keep bulls for service which may be used for artificial insemination work. The hospital units will also prove advantageous for detection and cure of sterility cases. In any such unit, where on an average, more than three inseminations may have to be done in a day, an assistant may be appointed especially for this work.

3. It would be desirable to establish in each political district one or more semen production centres from which the smaller units could be supplied with semen. The number of such centres will, of course depend on the density of livestock population and to a great extent on the local communication facilities. These centres wherever possible may be attached to a farm. With the semen production centres as the foci, the beginning can be made in the existing hospitals and as the work progresses, further extension can be made by opening a net-work of sub-units.

4. Each province should employ a specially qualified officer for supervising and organising the work of all the semen production centres and insemination units within the province.

5. In all countries where artificial insemination has been developed on sound lines there has been close co-operation between the laboratories and the field. It will therefore, be imperative to increase the research activities, specially at the Central Institute where the various problems relating to the theory and practice of artificial insemination are being extensively studied. It may be mentioned in passing that to facilitate research in all aspects, members from the staff of the Central Institute are being sent abroad to receive specialised training and gain experience of work in other countries. The provincial officers mentioned before may act as a liaison by reporting technical advances to the field workers and bringing field problems for solution to the Central Research Institute.

6. More emphasis should be given to the training of personnel. The provinces and States may therefore send trainees in greater number. It may also be advisable to open a long-term course at the Centre for turning out specialist officers.

7. To guide the development of artificial insemination work and to co-ordinate the work of the various Provinces and States a special committee as has been set up in Great Britain, may be formed under the Indian Council of Agricultural research consisting of members from the Centre and the Provinces and States.

APPENDIX. IV (1).

(*b*) Dr. T. W. Millen.

Technique of artificial insemination.

History of Development, at the Agricultural Institute, Allahabad.

The best method of collection of bull spermatozoa for artificial impregnation so far developed is the use of an artificial vagina in connection with a cow in oestrum, or with a dummy cow. The sample thus obtained is uncontaminated by vaginal secretions, is less likely to contain pathogenic bacteria and is of greater volume and concentration than that collected by any other method. Such samples have good keeping qualities.

We secured a bovine artificial vagina from America in 1941. The first collection of spermatozoa from a zebu bull using this technique was on November 16, 1940. Sindh Bad, a son of our late Sindh Queen was the bull used and cow No. 576 was inseminated with part of the sample. A female calf was born on August 16 1941 from this impregnation.

Small sized equipment was made from locally available material for use on sheep and goats. During 1941-42 seven "test-tube" kids were born in our herd.

In 1941-42 we undertook to eliminate Bang's disease and mycobacterial infections from our dairy cattle. All suspicious or reacting cows and buffaloes were impregnated artificially. We also stopped the serving of outside cows directly by our herd bulls. Many of the cows brought to our farm are difficult breeders. Often cheaper sources are tried first. These outside cows had undoubtedly been responsible for the disease appearing in our herd.

Results were very satisfactory and we soon had a large number of "test-tube" calves. The first buffalo calf resulting from artificial insemination in the world was born on August, 1943. We have named him "Bijwalla". He is now ready for service. In 1943-44 our registered Red Sindhi bull, Raj Kumar, a second son of Sindh Queen, sired 66 test-tube calves. For the 75 test-tube calves born that year 99 inseminations had been performed. The 47 calves born from 63 natural services were in no way superior to the test-tube calves and in either case four impregnations had resulted in the birth of three calves. In 1943 seven cows belonging to the public were impregnated artificially.

After hearing of our work and seeing the fine 'test-tube' calves develop into cows and bullocks, the public gradually overcame its prejudice to the new method. We received notes from cow owners in the city requesting the impregnation of their cows. We sent fresh sperm by bicycles, saving the cow and two attendants a long walk to and from our farm.

After repeated requests from various states to give instruction in artificial insemination, we held two short courses in 1945. These were attended primarily by veterinary graduates in the employ of Indian states. These men were given as much practical work as possible including the construction of some of the equipment used.

Our 100th test-tube calf was born in 1945. By March 31, 1946 a total of 129 test-tube calves had been born in our herd, 15 of which were buffalo calves. Many artificially impregnated cows and buffaloes were sold before their calves were born, so these numbers do not include all such calves produced.

We now have an electric refrigerator and telephone in our dairy office. The urban public willingly pay Re. 1 extra to have the sperm delivered on their telephonic order and increasing numbers of villagers are bringing their cows for artificial breeding. We often impregnate as many as five cows from the single ejaculation of a bull. Many more than this can be done by dilution, provided the cows in oestrum are available. We have several members of our staff trained for this work and give seven days per week service. In the morning about 8 o'clock if any cow in oestrum has been found in the paddock we collect sperm from one of our bulls. One half to one cubic centimeter is used for each cow. The remainder is put in the refrigerator in a cotton stoppered test-tube. Any cow from outside brought during the day is impregnated with this refrigerated sample. In our own herd we use samples refrigerated for 24 to 48 hours but we have not made any study of the length of time the sample can be kept. Spermatozoa have been found to be mobile after 72 hours storage and calves have been produced in our herd from sperm stored for 24 hours or more.

If we do not have a fresh sample in the refrigerator when a telephone call for sperm is received, we use a quiet cow in the breeding rack and collect a sample. The tube of sperm is then taken by bicycle and the cow is impregnated in her own stable. Sperm from our best Red Sindhi and Murrah buffalo is available for anyone's cow or buffalo. The cows that lie down as the bull mounts no longer escape pregnancy. Size is also of no significance as we can impregnate them whether they weigh 300 pounds or 1200 pounds.

Possibilities of artificial insemination.

India has been slow to utilize this method of rapidly increasing the effectiveness of her relatively small number of superior breeding bulls. Present systems of providing improved bulls have not been entirely satisfactory. Many government bulls are turned loose and soon become vicious, useless animals. Others are tied up and fed at government's expense but are little used. They become fat and lazy. The maximum number of services permitted is usually stipulated. Many cow owners are disappointed after a long walk leading or driving a fractious animal. Often cows come in oestrum in large number as the season changes. The first to bring his cow is fortunate; the others must seek inferior bulls.

Artificial insemination centres need not be expensive to set up and operate. Three men, two bulls and a quiet cow could care for all the cows in an area five miles or more in radius, especially if bicycle delivery is used. One man should preferably be a veterinary graduate with special training in artificial insemination and the other two trained cattle men. A shed for keeping the animals, a small office equipped with a laboratory, and a breeding rack should be provided. The other equipment used need not exceed as Rs. 100 in value. This would provide for the artificial vagina, glass speculum and applicators, a large tea kettle and small stove and a few bottles, test tubes, chemicals, etc. Valuable additions would be a microscope and a mechanical refrigerator.

These insemination centres could profitably be attached to veterinary hospitals, cooperative milk collecting unions or government or military farms without much

additional expense. States times could be fixed for the daily insemination of cows. One collection would suffice for each day and by using the bulls alternately it would seldom be necessary to use a bull oftener than twice a week.

Young bulls should be used to begin the work. They should be trained as described in 'Indian Farming' Volume VI, No. 11, November 1945. The bulls require exercise daily. This can be given in the form of light cart work or if nothing better, the bull can be led several miles each day. When the public see the bulls and find they can have their cows impregnated promptly, no matter how many cows are in oestrum, and especially after they see the resulting calves, prejudice against the method will disappear. A campaign for the castration of scrub bulls should accompany the introduction of insemination centres.

The saving in breeding bulls needed to serve an area and the resulting rapid improvement in the cattle should more than pay back the cost of running these insemination centres even though no fee is charged. We charge Rs. 4 for urban cows and Rs. 2 for village animals and have no trouble in collecting these fees. It is essential to see that no extra gratification is collected by personnel at the centre and that the public receive courteous, prompt service.

Further research is necessary to determine the best method for the preservation and transportation of sperm under Indian conditions. There are indications that the sperm of zebu bulls will not survive as long at the temperature of melting ice as will the sperm from bulls from colder countries. It is possible that the dilution of the sperm with proper buffers will make it practicable to ship it in thermos flasks containing ice.

We have tried the use of a clay hooka base containing cold water for transporting the sperm on rail trips. An attendant puts small pieces of ice from a thermos in the water from time to time to keep the water at about 40 degrees to 45 degrees F. The cotton-plugged test-tube of sperm is held in the top of the hooka base by a rubber stopper.

Once we have the solution to the storage and transportation problem, insemination out-stations can be set up far from the bull stables and fresh supplies of sperm can be secured regularly from the centres. The possibilities of rapidly improving the quality of the average cattle in this country are tremendous.

APPENDIX IV (1)

(c) Dr. R. B. Singh, Animal Geneticist, U. P., Livestock Research Station, Madhurikund, Muttra.

The exigencies of the war have greatly reduced the number of the cattle in every country. For the normal supply of the milk, meat and draft, every possible effort is to be made towards the development and improvement of livestock production. Artificial insemination is considered to hold a very great promise for animal improvement within a short period. Weddington (1942) regarded artificial insemination as of enormous potential importance for the immediate post-war reconstruction of the devastated areas of Europe. A report prepared by the allied agricultural experts and considered by the Technical Advisory Committee on Agriculture (1943) reveals that the supply of good breeding animals in Europe and other countries of the world, will be one of the greatest difficulties. Russel (1942) considers that in solving this problem, use will no doubt be made of artificial insemination.

In India the problem is much more serious than in many other countries in the world. Even before the war the supply of good bulls was very small or in other words negligent. A calculation of the figures given by N. C. Wright in his "Report on the

development of the cattle and dairy industries of India", 1937, reveals that there are about 3,500 females as against one approved cattle bull. For this problem as well as for the improvement of the livestock in India, the recourse has to be taken to scientific methods of breeding and particularly to artificial insemination.

Only recently this method was begun to be employed on large scale in some of the countries. Successs gained in Russia towards the improvement of livstock by the use of artificial insemination has drawn the attention of the people towards it.

In the U. S. S. R in 1930 about 20,000 cows were artificially inseminated. Within 8 years, the work speeded up to 60 times. According to Neumann (1939) 1,200,000 cows were inseminated in 1938. By this method in one district where 160 bulls were formerly required by the natural method, 37 bulls impregnated 8,000 cows in 1935.

This method has been widely used in sheep breeding in Russia. Ozin (1939) states that in 1938, 14,500,000 ewes were artificially inseminated involving the use of 41,274 rams with an average of 280 ewes per ram, where as for natural mating nearly 250,000 more rams would have been required. This practice is being used in other animals like pig, dog, rabbit and poultry, etc.

In Denmark this practice was started on large scale in 1936 (Sorenson 1938) by only one cooperative breeding society of dairy farmers. By 1941 this number had increased to 86 associations with total of 206,000 cows.

The U. S. A., artificial insemination has been used for several years in a few large herds of cattle and on large horse breeding farms. It was considered by Lambert and McKenzie (1940) that this method will be confined only to the herds which are large enough to employ the services of a technician. But with the improvement in technique in the last few years, the application of this method has been made possible to the advantage of general public with small herds. Trimberger (1942) stated that in 1942, 4 associations existed for this work in U. S. A.

Perry and Bartlett reported (1945) that 6 cooperative breeding associations have been working in New Jersey with 1,700 members and 15.000 cows. The associations own 40-45 bulls.

Regarding the increase of milk yield by the use of this method, Perry and Bartlett (1944) reported that the records of 112 members of three artificial insemination associations showed that average milk yield of 120 daughters produced by artificial insemination was 9·3% greater than that of their dams and the fat yield 1·4% greater. Records of 104 natural daughters from the same herds show average yields slightly lower than those of the 120 dams.

In Great Britain steps are being taken for the practical trial of artificial insemination of cattle. Some of the cattle breeding societies and farmers' cooperative societies have taken up this work on large scale.

In addition to the work on the application of this subject, researches are being done in the Universities and other institutions of these countries to improve the technique of collection of semen, its dilution and preservation and the insemination of the female. There are centres for the training of the personnel.

The whole work on artificial insemination in India before 1941 can be summarised as a hobby of a few teachers and field workers to exhibit the collection of semen and its introduction into the female genital tract.

It may be said that India made the first attempt towards this subject when the appointment of Assistant Research Officer, Artificial insemination, at the Indian

Veterinary Research Institute, Izatnagar was made. Later on the Punjab also started this work with the appointment of Animal Geneticist in 1943. In the United Provinces, the Agricultural Institute, Allahabad, has been practising artificial insemination on some of the Institute animals for some time past just to teach the students about this method. The U.P. Government made the first attempt towards it in 1945 when an Animal Geneticist was appointed. At all these centres experiments are in progress to perfect the technique of artificial insemination, for Indian conditions. Attempts have been made with success at Izatnagar, Allahabad (1945) and at Bharari to arrange for the technique to train the bulls to mount females not on heat and to ejaculate into artificial vagina. This method provides pure semen with sound sperms. At Izatnagar the method has been applied in Hariana. hill bulls and Murah buffaloes. At Allahabad Sindhi cows are treated and at Bharari Hariana breed and Murrah buffaloes are taken. In all these breeds the artificial insemination has been successful and has given high percentage of conception.

Vaidya and Bhattacharya reported (1945) about the results obtained at Izatnagar. The results show that cows have been impregnated with semen preserved for six days, buffalloes for three days, and sheep for seven days. Cows, she buffaloes, ewes and does (goat) have been inseminated successfully, using 1/22nd, 1/11th, 1/40th and 1/20th of a single ejaculation. They have found in one case that a cow was pregnant by the use of 1/60th of a single ejaculate. The percentage of successful impregnation so far obtained in the experimental animals at Izatnagar is 79 in cows, 80 in goats and 100 in ewes. It has been reported that overall percentage when the animals belonging to villages in the vicinity of the Institute are included, is 71 in cows, 63 in goats and 75 in ewes.

The artificial insemination work has been extended to villages near Izatnagar. The cattle are inseminated in some central villages where they are collected. The Civil Veterinary Hospital, Bareilly gets stored semen from the I. V. R. I. Izatnagar and collects cattle on heat from the town and neighbouring villages and inseminated them. After achieving a success at the hospital, a few centres are going to be started on the roads running out from Bareilly in the radius of about 12 miles. The cattle on heat will be collected on these centres every day and a man on cycle with requisites will visit these centres and will inseminate them.

At Bharari, the attempts are made to get the cattle on heat from villages for this work and they are inseminated at the Government Cattle Farm.

The Indian Veterinary Research Institute has opened four regional centres in different parts of the country to find out the utilitity of this method.

The comparison of the work in India with those in the countries referred to above, will indicate that artificial insemination is only in its infancy here in this country. But the results so far obtained are encouraging and demand the extension of this work. It is too early to use this method of animal breeding on large scale in this country for the following reasons :—

(*i*) lack of suitable workers, (*ii*) small herds of cattles cattered over such a large area (*iii*) lack of adequate facilities for transporting semen (*iv*) lack of education in farmers and their prejudices against any new system, (*v*) and above all the absence of sound cooperative societies amongst the agriculturist, which have been the means of success for using this method on large scale in foreign countries like Denmark, Russia and America, etc.

The following proposals are made for the extension of the practice of Artificial insemination :—

1. To provide facilities in the leading Institutions, Veterinary Colleges and Universities for the teaching of this subject,

2. To start at least one or more centres in every province and State in order to perfect the technique of artificial insemination according to the local needs.

3. Centres should be started in every province and State for using this method on large herds of the farm as well as for extending the work to the surrounding villages.

4. Trial should be made for the transport of the semen on the roads leading to villages and centres fixed where the surrounding villages may bring their animals on heat and get them inseminated; in this connection it may be pointed out that the semen used must be from an approved bull to ensure good progeny which will have great effect in the future development of artificial insemination in villages.

5. For the rapid extension of work in the Indian conditions, it seems advisable to find out suitable media by which the animals may be brought on heat within the desired period. The work at Bharari (Jhansi) towards this line, gives quite encouraging results in the case of cows. It will also create confidence in the villagers about the efficiency of the staff and the success of the proposed artificial insemination, in which they doubt very much.

6. For improving the technique of artificial insemination, researches should be carried on about getting accurate information regarding the various reproductive physiological processes in the Indian Farm animals.

7. The expenditure at this stage for all types of work in this connection should be borne by the Government and the organisation should be in the hands of the Government or responsible institutions like the Universities and the Colleges.

8. Every attempt must be made to avoid uncontrolled development of this system and to avoid pit falls.

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APPENDIX. IV (1)

(*a*) S. K. Sen, Animal Husbandry Officer, Bihar.

Probably no discovery in the domain of animal breeding has evoked so much interest and received so much publicity as artificial insemination. Nevertheless no one can have any doubt about the achievements of this process of breeding and the far reaching results so far obtained through its application in animal breeding.

The spectacular achievements secured by the sustained use of this method of breeding Russia and other countries have attracted the attention of the world, particularly those interested in livestock industry, to the possibilities of speedy

improvement of livestock. The fact that artificial breeding holds out immense possibilities in India, where bull production and maintenance are too expensive in comparison with the economic status of the rural people, cannot be over-emphasised, and it is with the realisation of the obvious results that a beginning has now been made in this direction by setting up a number of Artificial Insemination Centres by the Indian Institute of Veterinary Research of the Government of India, with the funds assigned for Grow More Food Compaign. Although this investigation has been launched for the present a short-term measure under this compaign, yet the results of artificial breeding will not assume any appreciable magnitude for sometime. The compaign is due to expire in February 1947, but it is expected that these centres, which have been opened as a result of hard labour and considerable preparations under various difficulties, like training of personnel, want of equipment, etc., will continue to function as a permanent appendage of the Indian Veterinary Research Institute or as post war schemes of the Provincial Governments. It is essential that opportunity must be given to complete the studies taken up on the problems affecting the application of artificial insemination and that exhaustive trials must be made on the means evolved to overcome the problems of storage and expeditions transport of semen.

It is not intended in this note to deal with the early history and the successive development of artificial breeding, but to indicate briefly the experience so far gained in the application of this method in this province and to set forth suggestions for it's wider use under conditions obtaining in this country.

One of the centres mentioned above is located at Patna where the concentration of cattle and buffaloes is fairly large and facilities of a Government farm are available. The work of artificial insemination actually began, under an Assistant Research Officer, from December, 1945, with two young Tharparkar bulls lent by the Government Cattle Farm. Due to the want of equipment and other facilities, the work has not been without frequent interruption. So far 682 cows and buffaloes have been inseminated.

The cattle owners of this area, both educated and illiterate, possess in varying degree, a strong sentimental apathy to artificial breeding. Conservative ideas peculiar to rural people of all countries and opposition to new ideas are largely responsible for this development at antagonism. They fear that the process being an unnatural one, cows become sterile or develop uterine diseases, that they do not get physiological or sexual satisfaction, and that milk yield is interfered with. They admit that there is no positive evidence or proof in support of their apprehension. These objections are often forcefully put forward when they argue that the cows belonging to Government Cattle Farm are not subjected to artificial insemination. Their contention is that, if artificial insemination is necessary for improving livestock, why it is not practised on cows of the Government Cattle Farm. There is another section of people who keep breeding bulls and charge fees ranging between Rs. 2/- and Rs. 4/- per service according to the type and breed of the bull. The attendants or cowmen accompanying the cows requiring service receive a commission of annas-/8/- to Re. 1/- from the bull-keepers. The popularity of the Insemination Centre, where no fees are charged and no commission is paid, naturally amounts to financial loss to these people. The combined opposition of all these people and of the illiterate owners, who object to the use of rubber and metal instruments, requires elimination by vigorous and sustained propaganda through developmental staff.

The strong arguments in favour of artificial insemination are however, the positive visible results showing the percentage of successful insemination and the size and quality of the progeny.

Apart from the problems stated above, the distance a cow has to travel in order to reach the Artificial Insemination Centre is a distinct disadvantage. Cattle breeders in this part of the country are general farmers, and they do not have sufficient time or inclination to pay individual attention to their cattle. Oestrum in cows is not often observed, and the village scrub bulls on the spot get the first opportunity of service. To an average cultivator, a *bull is a bull, irrespective of his quality, breed* or size. Even intensive, instructive propaganda will hardly make sufficient impression on the majority of cattle breeders unless the operation is actually demonstrated. So it is necessary to conduct demonstrational inseminations at selected villages, after preliminary negotiations with the cattle owners. So far many enquiries have been received from far and near in response to the press reports, announcing the opening of the Artificial Insemination Centre at Patna and describing the utility of artificial breeding. These enquiries mostly deal with the possibilities of inseminating cows not conceiving out of normal service. The other difficulties experience at this centre, which are of course avoidable under normal condition, are the lack of necessary equipment and appliances. Due to the scarcity of scientific appliances like microscope, refrigerator, etc., and non-availability of many others, brought about by war condition, the work is often interfered with and continuity is not maintained. So it is essential to provide all the necessary equipment from the very early stage.

To achieve any amount of reasonble success, it is necessary to enlist the willing co-operation of the extension staff as well as of officers and men of Co-operative, Rural Development. Agriculture and Revenue Departments. Their help and influence. in carrying on active propaganda work in rural areas are of great value for extension of artificial insemination.

Inspite of so many factors operating against the use of artificial insemination, the centre at Patna is inseminating, on an average, 4 to 5 cows and buffaloes a day, and at this early stage this figure can be considered satisfactory. The reason for this attendance is that a great prercentage of village cows do not easily conceive through normal service, as they are believed to suffer from "temporary sterility"! When a number of services by village bulls does not produce any result, the owners show their keenness to give a chance to artificial insemination. Cows suffering from other forms or sterility due to physical malformation and physiological causes are also brought to this centre for treatment. The "temporary sterility" appears to be quite common, and it will be interesting to investigate its causes. It seems probable that this infertility is due to malnutrition, resulting from the absence of vitamins and also proteins in their food. At the centre these cows are inseminated and owners are given instructions to improve the plan of nutrition by better feeding.

Bulls so far used at this centre are of the Tharparkar breed reared on the Government Cattle Farm, Patna. These animals are heavy and phlegmatic, often having pendulous sheath. Bulls of these type have been observed to be very slow even in normal service and often they refuse to serve. Training such bulls for semen collection has been found to be more difficult than the active types, like Hariana. Semen collection of such bulls with *anoestrous* cows is not possible. Similar difficulty has been reported by Daubney in East Africa with Sahiwal bulls. If such heavy or slow breeds are to be used, it will be an advantage to try out mechanical or other methods of semen collection. In order to popularise the application of artificial insemination, it is advisable to use lighter breeds bulls which are quick in service.

Two Murrah buffaloes bulls have recently been added to this centre, and insemination inbuffalces has just started. The definite mating season in buffaloes will provide a good opportunity to inseminate a large number of animals within a short interval, which will allow a thorough study of this process in this species. It seems

that the normal amount of concentrates allowed to the young bulls on the farm is not adequate when they are used for semen collection. They quickly lose condition, if not properly fed. Therefore, it is advisable to keep a careful watch on the feeding of the bulls used for artificial insemination. The study of the effects of feeding on the quantity and quality of semen will be an appropriate subject for investigation.

So far experience gained at this centre has provided sufficient encouragement to open additional centres at Dinapore and Bankipore which are about 4 and 7 miles away from the centre respectively. These centres are attended every day by the Assistant Research Officer, and semen is carried in a flask packed with ice. While the A. R. O. is present at these centres all the cows brought there are inseminated. Unless a whole-time trained assistant is stationed at each of these places to attend to the cows at all times of the day, the success of these centres will only be partial It is not possible for the A. R. O. to be present at all these places in the same morning.

The collection of semen, its treatment and transport will have to be simplified, to suit the local conditions and manner of transport. The viability of spermatozoa under normal temperature, pressure and humidity will have to be studied, with a view to prolonging their viability. For wider application of artificial insemination, it seems that a chain of insemination centres with their ramifications must be set up and this must be accompanied by all kinds of intensive propaganda among the rural cattle owners. The possibility of the formation of breeding societies in order to enlighten the outlook of cattle owners, to gain confidence and to explain the economic consideration of artificial breeding must be explored. The problem of transport and preservation of semen will, no doubt, gradually improve, along with the post war development of quicker communication and air traffic. The use of carrier pigeons to carry tubes containing semen may prove useful. The necessity of refrigerating appliances for storage in rural centres cannot be overlooked, especially where electricity is available. With the extension of electrificiation of rural areas, as envisaged in the post war developmental plan, will be of considerable help in opening larger number of such centres in villages. It must also be emphasised that the authorities concerned and the public will have to exhibit patience and not expect quick results as often demanded of research or investigation schemes. The success of such an enterprise will largely depend on the ability of the staff employed to inspire confidence and to show positive results to the cattle owners.

Recommendations:—

(1) To overcome the difficulties enumerated above and (2) to facilitate the extension of artificial breeding *vis a vis* the experience so far gained, following recommendations are made.

1. (*a*) The staff appointed for artificial insemination should be very carefully selected. They should not only receive intensive and specialised training, but must possess untiring patience and perseverance to face difficulties and opposition in order to solve problems which confront them in their routine work. In order to obtain services of such men, it is strongly recommended that attractive scales of salary must be offered to the Assistant Reserarch Officers and Staff, and assurance must be given in regard to their permanency, should the scheme succeed.

(*b*) At the initial stage intensive propaganda through press, by means of hand-bills, cinema films, by lectures, actual demonstration and by mobile inseminating units will be of great help in popularising artificial breeding in rural areas. Help and active co-operation from the staff of Veterinary and Agriculture and other departments should be sought for propaganda work. It is necessary to publish every month

figures showing the number of insemination done in the form of a press report and also include in it the names of new centres opened. Radio talks on artificial insemination by prominent men who are able to inspire confidence, will help to dispell misapprehensions.

(c) Although animals belonging to Government Farm do not require artificial insemination, yet its practice has got a great propaganda value to the cattle owners in general, in so far as it removes a good deal of prejudice and makes them believe that artificial insemination is not harmful.

(d) At the initial stage of this scheme bulls of active breeds should be used, so that time is not wasted in semen collection.

(e) Insemination should be carried out in villages after making previous arrangements with the owners. Such insemination at random will greatly facilitate the extension work in those areas where successful insemination has been made. In areas where buffaloes predominate such random insemination would be highly desirable, especially because the breeding season in buffaloes is well defined.

(f) When any new centre is opened, there should be a whole-time assistant to attend to animals which are brought for insemination. If for any reason animals have to be taken back without insemination the centre will never be popular.

(g) Arrangement must be made to secure necessary equipment before a centre is opened.

(h) Research must be conducted on simplifying the methods of storage, transport and viability of semen. Duration of viability in normal temperature, pressure and humidity must be studied under various conditions with a view to prolonged preservation.

2. (a) Extension of artificial breeding at this stage should proceed slowly and frequent modifications in the operation may have to be made from time to time in the light of experience gained. There should be, no doubt, a central station with a fully equipped laboratory and staff where routine problems can be investigated and solved. A net work of smaller units, with necessary equipment, should be opened at all important veterinary hospitals and breeding farms.

(b) These units should be located in or near about the areas where the concentration of animals is large and where breeding and milk recording schemes are in operation. At these units semen collection should be done and semen kept in preservation. From these centres semen should be carried in flask to outlying centres within 10 to 15 miles where a trained stockman should be stationed. The stockmen will be required in his routine duties to approach the village cultivators and apprise them of the benefit of artificial breeding and collect suitable animals for insemination every day. Thus, in this fashion, the number of units can be multiplied, until the entire field is covered.

(c) In many cases, the journeys between the centre and the outlying centres will be avoided by using homing pigeons for carrying semen from the centre to the outlying point.

(d) Efforts should be made to form village breeding societies where main purpose should be the propagation of the artificial insemination.

(e) Where artificial insemination work is contemplated, Livestock Improvement Act, providing for compulsory castration of scrub bulls and licensing of bulls should be enforced.

Therefore, in the post war developmental plans, provision should be made for establishing an artificial insemination centre with its sub-centres and units, as proposed in this note.

APPENDIX. IV (2)

TO CONSIDER THE SCOPE FOR INCREASED DUCK AND GOOSE PRODUCTION. THE AREAS SUITABLE FOR IT AND THE STEPS THAT SHOULD BE TAKEN TO ENCOURAGE IT.

(a) By S. G. Iyer and Mohd. Athar Ali, Poultry Research Section, Indian Veterinary Research Institute, Izatnagar.

India and Burma contain about one-fifth of the world's recorded duck population and the total value of ducks and geese in India has been estimated to be one crore of rupees. Ducks are primarily raised for production of eggs, and except in cities the demand for birds for the table is not much. Geese are found everywhere in the country and for table they are considered excellent. On lands with plenty of grass, geese do very well and need no special food. For keeping a lawn clipped geese are ideal.

Duck raising.

Breeding and rearing of ducks under Indian conditions is not at all difficult, indeed it is easy to maintain them. To construct a proper house does not cost much, grounds are cheap, tanks, ponds and rivers are numerous and, therefore, there is every scope for developing this branch of poultry industry. Ducks do very well on any soil provided they have access to water. Running water is the best but tanks that do not dry in the hot months will serve the purpose. Ducks can be reared in areas without tanks and ponds by giving them a large vessel with water so that they may bathe. In western countries ducks are also kept away from water, but in India it is usually the practice to keep ducks mostly in localities having surface water. The initial cost for the production of ducks is usually not small, but the money recoverey by the sale of eggs and surplus stock is easily four times in a year. These days importations of poultry are somewhat difficult and the best ducks are, therefore, to be seen in zoos at certain provincial headquarters. Ceylon used to import large numbers of duck eggs from Madras but this trade is almost extinct owing to the import duty. All the domestic varieties of ducks are said to have originated from the Mallard or wild duck with one exception, the Muscovy which is native of South America and descended from wild ancestors. Eggs of wild ducks were collected and hens used to hatch the ducklings which became fairly domesticated and this is believd to have taken place in Europe before the Christian era. The present day varieties are obviously produced by crossing. In Western countries until 50 years ago ducks were kept for their table qualities, since then the higher producers of eggs have become popular. But in India no proper method of breeding and rearing are adopted, as a result ducks that we see in the market are deteriorated birds.

Advantages of keeping ducks.

Time has come to regard duck farming as an essential corollary to a successful agricultural enterprise. The duck offers comparatively greater profits, as they, in India, are said to be less susceptible to poultry diseases than the fowls, but recent efforts by the Central Command to increase duck production in Bengal, Central Province and other parts of India have shown that heavy mortality among these birds is all too common. In fact it is singularly free from most diseases particularly Ranikhet disease which has proved a stumbling block to the poultry industry as many farmers have had to wind up business once the disease has visited their premises. Ducks also lay more and larger eggs, for instance, the weight of 53 eggs laid annually by a desi hen would be about 5 lb. compared with 90 eggs laid by a duck which

would weigh 12·5 lb. or which is two and a half tims the weight of hen eggs. In Burma ducks are estimated to lay 180 eggs annually and the hens only 40. It is well to remember that the net profit from a laying hen or duck is not obtained only from the number of eggs laid but it depends upon fertility, hatchability, rearability, mortality in all stages, susceptibility or resistance to disease, longivity, breeding ability, percentage culls and proportionate cost of husing. However, of all species of the feathered world ducks excel in each of these characters.

The properly bred duck is highly fertile. It is easy to hatch duck eggs in incubators, although it takes 7 days more than hen eggs. Ducks grow quicker than other type of poultry and come to lay at a relatively much earlier age. Mortality due to non-specific causes is stated to be insignificant, generally the result of accident only. They allow a margin of abuse and ignorance in management that no other creature in the farm will permit.

Owing to the important role played by snails in the life history of Trematod infestation of large animals, the modern practice in regard to the control of this parasite is to rear ducks on lands intended for cattle grazing. Ducks can be used for manuring arable fields and heavy crops are obtained in Western countries after their occupation.

Bye-products

The feathers realise from 1—2 Rs. per lb. or roughly 4 annas per duck and should cover cost of plucking. In Western countries consignments of all white feathers realise the best prices. In some areas the manure can also be sold or it can be given to the cultivators in return to the litter. Owing to different prices the downs (fine feather) and the feathers must be kept separate.

Prejudice against duck eggs.

It has often been said that duck egg farming offers no prospect of success as it may prove difficult to sell eggs produced in large numbers. Duck eggs have a distinct flavour of their own rather too strong for the ordinary palate, and, therefore they are not much in demand for table use. However, in this connection, we would like to state that there is nothing unwholesome in the duck eggs. They are larger, better shelled and of greater density than the hen eggs and possess almost the same biological value.

It is interesting to note here as to how this undesirable flavour in the eggs and meat develop and how they can be eliminated by improved living conditions, feeding and management. Ducks have an especial weakness of sampling all the foul water they can find ; and probably there is something in such material that satisfies a craving which is dictated by the bird's natural appetite. This is most undesirable from utility point of view. If the birds are given good food which does not contain any strong tasting ingredient and are allowed to drink clean and wholesome water, certainly they can produce sweet and mild tasting eggs to the satisfaction of an average consumer. Duck eggs can be readily used in the preparation of cakes, etc.

Production and demand.

It is no easy matter to dispose of the surplus drakes. Some people do not like ducks as table poultry, the general complaint being that the flesh is too strong in taste and perhaps this is because, as stated above, in natural conditions the duck is a scavenger and revels in dirty water and paddles. If we treat ducks in the same way as we treat our hens, there is no reason why both the flesh and eggs should not be mild as that of the chicken. It is urgently necessary that these facts are made known to the

public by demonstration and propaganda, the prejuduce will be shaken off and the demand of the table ducks will soon be on the increase. The second world war has no doubt contributed a great deal for the popularity of duck meat and duck eggs in the human food in this country.

Localisation of duck production.

Unlike the fowl, which thrives equally well in many parts of the country, the duck is definitely more sensitive towards its environment. As they are semi-acquatic birds by nature, they prefer wet and muddy conditions, tanks, rivers, ponds and deep paddy and jute fields. They thrive in areas where they can pick up weeds, plant roots and other foods including small fish and snails.. *Duck farming is, therefore, a decidedly regional subject.* It is at its best in the east and south and west coast of India, where there is abundance of water. Ducks are almost absent in dry areas like Rajputana, Baluchistan, Central India States, Sind, Cutch and Kathiawar, while Kashmir has fairly good duck population. The last three areas, with the exception of Kashmir of course, have great length of sea coast, but they do not possess muddy conditions necessary for a successful duck raising.

A survey carried out recently by the Central Marketing Department (Fig. 1) indicates that Travancore, Cochin and Madras and Bengal are the places where semi-aquatic conditions prevail and ducks are being raised in large numbers in these areas. The specimen of ducks produced is regretably undersized.

There are also other vast areas in the country ; their usefulness for raising ducks has to be explored. For example in certain parts of Bombay Presidency where natural conditions are quite suitable the duck population is sparse. Attempts could, however, be made to introduce raising of ducks in such areas and other possible centres such as canal irrigated tracts of the Punjab. It is, however, necessary that small scale experimental trials should first be made to gain experience of local problems.

A survey carried out by the Central Agricultural Marketing Department indicates that the Madras Presidency produces as much as 40·9 per cent. of the total duck eggs in India, and Bengal about 34·4 per cent. The United Provinces produce only 6·6 per cent. whereas the provinces of Bihar and Orissa produce 3·4 per cent. and 2·6 per cent. respectively. Amongst the Indian States Travancore produces as much as 3·8 per cent. of the total duck population.

The production is concentrated on east coast and extends throughout the west coast of Burma. The propduction is also concentrated in certain parts of Bengal especially the east and the Malabar and Central Travancore. The United Provinces and North Bihar also are areas of fair production. The production is also fairly intense in the deltaic region of Godavari and Tanjore district of Madras Presidency, Chittagong and deltaic regions of lower Burma.

Number and size of the eggs produced.

It has been estimated that the average production per duck per year in India is 90 eggs, and 180 eggs in Burma. In Cochin and Travancore an annual production of 120 eggs per duck is adopted for all the laying ducks. In Bengal and Madras the annual production per duck is 75 and 126 eggs respectively. The ducks, under village conditions, however, have been estimated to lay much smaller number of eggs, and it is certainly due to improper feeding and poor management. Furthermore, there is a distinct drop in the production capacity of ducks in the Punjab (50), Sind (40), the Central India States (40). The average weight per hundred eggs also varies from 17 lb. in Cochin State to 10 lb. 8 oz. in Bengal.

Some common Indian breeds of ducks.

Breeds of ducks.—There are several breeds of ducks some being ornamental but of no use in a laying pen. There are about eight best breeds and any one of these can be profitably kept in this country. The different breeds are Aylesbury, Pekin Rouen, Cayuga, Muscovy, Indian Runner, Orphington and Khaki Campbell. The pure bred birds ever give the best results and therefore, one should invest money only in pure breeds. Some people are fond of making new breeds by crossing and the following crosses are known to produce the best results. Rouen drake and Aylesbury duck, Pekin drake and Aylesbury duck, Muscovy drake and Aylesbury or Pekin duck, Pekin drake and Indian Runner duck, and Indian Runner drake and the common Indian Duck.

The common Indian breeds of ducks are, the Indian Runner, the Sylhet mete and the White Breasted Nageswari.

The Indian Runner is found practically in all parts of India, but in a few places they are bred pure. They are remarkable birds in all respects, and were developed as the first commercial laying duck in England. As no attempt has been made to improve the condition of breeding and management, it is suggested that every possible effort should be made for the betterment of this variety of profitable ducks, under Indian conditions. In India, however, the average live weight of a duck and a drake is 4½ lb. and 5½ lb. respectively, and a village duck of this breed lays on an average 54 eggs in a year.

The other indigenous type of duck is the Sylhet mete, which is the ordinary duck of the villages in Eastern India. An adult bird weighs 3 to 4 lb. and under village conditions it is estimated to lay 40 to 60 eggs a year.

The Nageswari Duck is found in the district of Cachar and Sylhet in the Surma valley of Assam and in Eastern Bengal. An adult bird weighs 3 to 4 lb. and under village conditions, however, it is estimated to lay 50 to 60 eggs a year. The average weight of eggs of the Indian breeds is 1¾ to 2 oz.

Breeding.

Apart from the indigenous breeds there are a number of improved breeds, but only in a few places they are bred pure. The best improved breeds for egg production are Indian Runners, Khaki Campbell, Buff Orpingtons and Magpie ducks, while Pouen, Aylesbury, Pekin and Muscovy ducks are also well known as table birds.

It is a well known fact that the pure breed always gives the best results, but only in a few places in India the ducks are pure bred. So far as crossbred ducks are concerned, it has been found that for all intents and purposes the improved Indian Runner and Khaki Campbell drakes mated with the common Indian Duck produces very fine layers.

Missioneries have done some pioneer work in the South and in order to improve the common duck recommended as follows :—Mate a strong Indian Runner drake with four large-size common Indian ducks. Select four large ducks of this cross and mate them with a medium size Aylesbury drake. The resulting cross will be large hardy ducks making excellent table birds and layers. When crossing different breeds it is better to separate the drake from ducks of his own breed and put him with ducks of the other breed.

In breeding must be carefully avoided and the male bird changed every two years. Ducks begin to lay when they are 6—8 months old, and, for breeding, the bird must be one year old and can be bred until four years of age. One drake usually

takes four ducks. The secret of success in breeding is rigid selection and breeding from only the best. Breeders do better when they have access to swimming water, best in the early part of the season. Fertility is sometimes poor in the early part of the year and may be due to causes such as unsuitable houses, cold winds, fright, under or over-mating, improper feeding, lack of grain and over fatness. When fertility is poor in early part of the season, increase the number of drakes and decrease as season continues. The season in western countries is normally 8 months from February to September. It should be possible to produce ducklings all the year round but this requires considerable skill.

In India ducks commence to lay during the rains and keep on laying until April. Ducks lay their eggs during night as well as morning say up to 10 a.m. They generally lay anywhere on the ground sometimes in the water. The eggs should, therefore, be carefully watched and collected.

Efforts for improvement.

In order to improve the laying and meat qualities, it would be necessary to upgrade the common indigenous duck scattered over the country preferably with pure-bred Indian Runner and Khaki Campbell drakes preferably under free range conditions. The Khaki Campbell was produced towards the end of the last century chiefly by using the Runner duck crossed with the Rouen and introducing Mallard blood. The flock average is from 190 to 200 eggs a year. This is a dual purpose waterfowl a good layer and a good table bird. As there is no recognised duck breeding farm in India, we are afraid that pure-bred drakes may not be procurable at present, which necessitate, the establishment of a Central Duck-raising Farm in concentrated areas where all scientific methods of duck breeding may be adopted to raise a pure stock. Perhaps one of the regional centres for the proposed commodity stations is Trivandrum (Travancore State) and in our opinion it would be best to organise an experimental duck breeding farm in this place with an aim to maintain 1,000 layers. Added to this a similar regional centre for duck breeding may be organised in East Bengal so that results obtained from the two stations may be compared.

Fundamental research into breeding, feeding, housing and management of duck is the first essential thing in the developmental operations before launching a country-wide programme of work. Specialised training in duck keeping should also be arranged by these stations. It seems at present that the foundation stock will have to be imported from abroad, which will serve as a nucleus for further developmental work.

Hatching Duck Eggs.

In order to establish the duck industry on a sound basis, it is very necessary to encourage the artificial incubation of eggs. This will not only result in the prevention of losses that at present occur under village methods of incubation but also permit to handle large numbers of eggs at a time which is the essential feature of a successful industry. There are, however, about a dozen hatcheries in Burma, which hatch a large number of duck eggs. As the hatcheries are owned and managed by the Chinese, the process adopted there is highly artificial and although they are operating in Burma from a long time, the Burmese themselves have not been able to master the science and art of artificial hatching as practised by the Chinese. However, in India all the eggs hatched are set under broody hens or ducks except a few farms where small sized mechanical incubators are used. It will not be out of place to mention here that Mammoth incubators in all parts of India may also be used for hatching large numbers of eggs. Since no information in regard to the various factors of in-

cubation is available, it is desirable that preliminary experimentation be made in concentrated areas like Cochin, Travancore, Madras and Bengal and the knowledge gained disseminated to the public. Under village conditions for the present it would be advisable to recommend the traditional ancient method of hatching under hen. Only six eggs should be placed under a hen. The Game or Chittagong hens make the best mothers for ducklings. Two or three hens should be set at the same time and when the ducklings are out, give each hen from six to eight.

Successful management of ducks.

It is commonly known that ducks are definitely temperamental, very timid and easily frightened. They do, however, become totally upset by the slightest accident and stop laying for four to five weeks or even longer when frightened. Hence every effort should be made to keep them happy and comfortable. As already mentioned they must always have plenty of fresh air and water together with sufficient pasture for foraging.

Feeding of the ducks.

It has already been mentioned that in Burma the average annual production of eggs per duck is 180 eggs which is obviously double that of the average in India. Though there might, however, be some difference in the breed or type, the higher average of duck eggs production in Burma is probably due to careful feeding and management adopted there, whereas no systematic methods are followed in India. The most prevalent practice in India is to allow them to pick up the kitchen remnants and sweeps, drive them to the tanks and ponds where they remain throughout the whole day and live upon weeds, snails and also fish. However, a few organised duck farms in Bengal are attempting to improve the feeding methods, keeping in view economics but no substantial results have yet been achieved, and, therefore it would be worthwhile to investigate the possibility of improvement in regard to duck feeding. We wish to make it clear that the protein level in the duck feeding will have to be considerably increased by adequate supplements, with cheap vegetable and animal proteins in order to increase the productive capacity of the ducks in India. The food consumption of ducklings beyond the age of 6 weeks is not much and the amount of food required depends upon range as ducks are good foragers.

Possibilities of the export of duck eggs and other products.

It is expected that the improved duck will lay larger number of eggs under better environmental conditions and good management. As suitable conditions for duck raising exist near about the various ports in India, the possibility of commercialised farming in these areas, and the supply of duck eggs to the shippers at a reasonable price must be considered.

In some of the most concentrated duck raising areas, where the production is expected to go very high, the desirability of drying of surplus eggs may be considered, and it is hoped that not at a distant future, we may be in a position to place dried duck egg product commercially in a foreign market. We must however, keep the Country's demand first before planning for an export trade.

The possibility of establishing the frozen and canned meat industries in India may also be considered. It is well known that processed meat products will not find favour in Indian household and hence foreign markets will have to be explored for the expansion of this industry. As the production cost will be comparatively cheaper in India and as refrigerated shipping space will be easily available after some time, we may be able to deliver our frozen egg and meat products at any foreign mar-

ket at a low competitive price. Fundamental research in the experimental duck breeding stations in regard to storing and processing of duck-eggs and meat should be undertaken.

In the conclusion it may be said that duck farming offers a vast scope in this country. It may be mentioned that Government have given due recognition to the improvement of fowl keeping in this country, as a result of which organised poultry farms are being established all over, but no attention is being paid to the improvement of ducks. We are perhaps aware that the military in India have sponsored schemes for the raising of poultry to supply with vital food stuffs and a number of duck-breeding farms have been started during the war period. Since the war is now over it is suggested that all the duck farms owned by the military authorities be taken over by the civil administration and investigational work in different directions may be initiated to establish this inidustry on a profitable footing as envisaged in previous paragraphs, but fundamental research work should be confined to the regional stations under the control of the centre. We are fully confident that the duck industry will get the due share in the recently announced plan for the development of agriculture and animal husbandry.

Geese.

Geese can be easily kept wherever there is a large field or waste land on which they can run, green grass forming the major part of their food. Unless they have a tank or pond in which to swim, their eggs may not be fertile and the birds will not be comfortable.

A survey carried out by the Central Agricultural Marketing Department indicates that the number of laying geese is small and they are found mostly in Bengal and Bihar. In India geese are, however, seldom maintained for egg production, as they lay relatively few eggs and require special attention and heavy feeding. Sometimes, they are kept as pets by the private persons, but they are generally reared for table purpose particularly during X'mas for selling to Europeans.

Nature and habit of geese.

It is commonly known that by nature and habit, geese have certain characteristics common to ducks and their distribution is also somewhat similar to that of ducks. The production of the goose is mostly confined to the months of February and March.

They generally lay all the eggs in a clutch and the average annual production of eggs for areas where they are commonly kept is 9 eggs per annum per goose, but it is 12—15 per goose for over three-fourths of the area. They, however, lay 25—30 eggs in Bengal, Cochin and Travancore.

Common breeds of geese in India.

The common Indian breeds of geese are white geese and brown backed geese. The white goose is white all over, while brown backed goose has a white belly and brown wings at backs and head. The average weight of a gander and a goose is 7½ to 8 lbs. and 6½ to 7½ lbs. respectively. They lay in two clutches a year of 8 to 10 each, and they are excellent birds for table.

There are, however, several improved varieties such as the Toulouse, Embden and the African geese that can be kept in India ; apart from these the Indian geese are also quite nice, but not so good as any of the improved varieties already mentioned.

Lastly, it may be added that since a number of problems in connection with the improvement of fowls and ducks have got to be tackled immediately, the question of

geese developmental work may pend for some future date. It is well to keep in view that geese would never be as profitable as fowls and ducks if they are to be supplied with adequate food necessary for maintenance and egg production.

Our recommendations concerning what should be done to promote duck and geese husbandry are as follows :—

1. As there is an undoubtedly scope for the improvement of Indian ducks both in body size and egg laying capacity, by controlled breeding and management, the Improved Indian Runner and Khaki Campbell should be used extensively for upgrading the common Indian duck as it produces a very fine layer.

2. A Central Duck Farm of about 1,000 laying birds should be established in a duck raising district, such as Trivandrum, for the production of pure-bred drakes. A similar centre should be established in East Bengal. The foundation stock of these farms may have to be imported.

3. Where the pronounced flavour of duck eggs reduces their popularity as food to a material extent, the economics of changes in management and feeding which will remove the flavour should be studied with a view to overcoming the objection. In any case, the economics of hand-feeding ducks should be studied.

4. The best way of incubating duck eggs in India has yet to be ascertained and demands research, but under village conditions for the present the traditional method should be encouraged.

5. There appears to be a profitable export market available for table duck and duck-eggs. The best method of storing and processing these products for the market should be discovered.

6. Regional experimental duck breeding and research stations should be established duck farms being given up by the military authorities should be acquired for that purpose.

7. Fundamental research should be controlled from the Central Institute.

8. As geese will never be as profitable as fowls or ducks, there is no special call for their development.

APPENDIX IV (2)

Map of India showing the production of Duck eggs.

(b) Dr. L. C. Sikka, Assistant Director of Agriculture (Livestock), Bengal.

(A) *Ducks.*

1. *Conditions necessary for successful production*—Ducks are best kept under swampy and marshy conditions, provided their house is kept dry. This is not only because of the swimming water which such areas provide, but also because of the excellent animal food-molluscs, crustaceans, fish etc.—they furnish. No doubt, there are breeds of ducks (Indian Runner and Khaki Campbell to mention two) which, if necessary, can be 'dry' reared, but even in these breeds swimming water, if provided leads to improved fertility, hatchability and rearibility. Besides, the food the birds pick up, keeps the food bill down. While, therefore, ducks can be, and are in some cases reared under 'dry' conditions, they are reared most economically under conditions obtaining in low lying areas.

2. *Scope for increased production in Bengal*—Bengal with its heavy rainfall, low lands, and large number of tanks, *Beels and khals* provides excellent conditions for duck production. And, in fact, more ducks are kept in Bengal than in any other part of India. According to the Report on the marketing of Eggs in India and Burma (1938), nearly 43% of the total duck population of India is kept in Bengal. The latest all-India figure is not available; but the latest (1945) livestock Census for Bengal has revealed that the number of ducks has increased by 35%, while the number of

poultry has decreased by 18% since 1940 in this province. That there has been an increase in the number of ducks, inspite of the very heavy and abnormal demand for eggs and fowls for consumption by the Army, is most remarkable.

A scrutiny of the figures showing the incidence of duck population on the net cropped area, area of tanks, and area of total water surface, in different parts of this province, has revealed wide variations which are hard to explain. The relevant data in this respect for each district are presented in the following statement, wherein the number of poultry, and the numbers of total poultry and ducks, per 100 acres of net cropped area are also shown :—

District.	No. of ducks per 100 acres of—			No. of poultry per 100 acres of net croped area.	Total No. of poultry & ducks per 100 acres net croped area.	Muslim population % of total population.
	Net croped area.	Tank area.	Total water surface.			
Noakhali	84·5	1057·7	258·3	158·9	243·4	81·35
Tipperah	75·1	1364·0	642·5	145·5	220·6	77·09
Bakarganj	45·3	1533·5	210·9	85·0	130·3	72·33
Howrah	36·3	431·1	270·2	51·1	87·4	19·88
Bogra	32·7	1041·2	381·1	85·0	141·4	83·93
24-Parganas ..	30·0	765·5	202·7	40·1	70·1	32·47
Hooghly	28·7	326·7	225·8	41·1	69·8	15·03
Birbhum	26·5	281·2	190·7	46·7	73·2	27·41
Khulna	24·9	2513·3	222·7	47·0	71·9	49·36
Burdwan	23·1	239·9	159·8	39·7	62·8	17·81
Dinajpore	21·4	543·9	295·9	58·5	79·9	50·20
Rangpur	20·1	2464·2	127·3	85·0	105·1	71·41
Chittagong ..	19·6	283·9	93·5	142·9	162·5	74·55
Mymensingh ..	19·6	1954·9	184·0	79·4	99·0	77·44
Dacca	18·1	974·8	189·0	96·8	114·9	67·29
Rajshahi	17·8	498·0	172·5	76·6	82·4	74·64
Bankura	15·4	163·5	84·3	34·5	49·9	4·31
Jessore	11·7	1159·9	167·0	71·3	83·0	60·21
Jalpaiguri	11·4	2106·8	126·3	40·8	52·2	23·08
Pabna	10·6	804·0	49·0	75·9	86·5	7 ·66
Faridpur	10·2	458·5	52·0	71·7	81·9	64·78
Murshidabad ..	8·0	312·3	88·1	68·0	76·0	56·55
Midnapore	7·6	135·6	70·5	24·2	31·8	7·73
Nadia	6·5	618·1	74·9	69·9	76·4	61·26
Malda	5·1	211·0	50·1	39·9	45·0	56·78
Darjeeling	4·0	..	..	100·2	104·2	2·42
Chittagong Hill Tracts. ..	2·1	..	..	87·2	89·3	2·94
Total Bengal ..	22·9	*645·9	*177·0	71·4	94·3	54·73

* Excluding the districts of Darjeeling and Chittagong Hill Tracts.

It will be observed that (*i*) ignoring the two hilly districts, Darjeeling and Chittagong Hill Tracts, where conditions for duck rearing cannot be favourable, the number of ducks per 100 acres of net cropped area varies from 5·1 in Malda to 84·5 in Noakhali, (*ii*) the smaller numbers are, with a few exceptions, not due to want of water, and (*iii*) there is little sign of any correlation between the number of poultry and number of ducks kept in each district, except that (*a*) the two districts having the highest numbers of ducks also have the highest numbers of poultry, and (*b*) where Hindus form (a) majority of the human population, there is an evidence of negative correlation, which is due to the fact that while poultry keeping is tabooed for the Caste Hindus, no such taboo exists against duck keeping. Ducks and poultry, as kept in Bengal villages, largely find their food themselves by

roaming about the villages. What they thus pick up may be supplemented with small quantities of paddy and / or boiled rice once or twice a day. Under this system, although the birds do not produce what they may be capable of, eggs and birds are certainly produced most economically, for it costs the villagers little or nothing to maintain their birds. There is nothing to show what is the optimum carrying capacity of our lands under such condition. It is, therefore, not known how the incidence of ducks and poultry on land, as obtained in the Noakhali District which is the highest for the province, would compare with this optimum. Nevertheless, the system of keeping poultry and ducks in that district is little different from what is obtaining in other areas keeping much smaller numbers. Yet, inspite of this, the average egg production or live weight per bird is no lower in the former than in the latter, which shows that the food available per bird, for the very much larger population, is not a limiting factor in the former. This indirect evidence should indicate the very great scope for increasing the number of birds (both ducks and poultry) in the latter districts, even with the existing system of management. Of course, by practising intensive or semi-intensive systems, under which birds are stall fed, the number even in the Noakhali District can be multiplied many times.

3. *Steps necessary to increase production* :—

(*a*) From the foregoing it would appear that *prima facie* there seems no special reason for the great variation in the number of ducks kept in different parts of the province. Perhaps the reason for these differences lies in the general inaptitude and lack of interest of the people. But to ensure that there is nothing more than that, the question should be thoroughly investigated. The optimum duck and poultry carrying capacity of land, under different conditions, should be determined. The amount of food the birds can pick up under the present system of management, and what this should be supplemented with to obtain increased production most economically should be found out.

(*b*) At present there are no specialised duck farms in this province. The total stock is distributed over thousands of flocks of a few ducks each. Data showing the economics of large scale duck farming under Indian conditions are wanting. These should be obtained to show if large scale duck keeping for table birds and/or for egg production can be a paying proposition, and under what conditions. The economics of large scale duck hatchery business should also be investigated.

(*c*) Duck keeping should be popularised by (*i*) vigorous propaganda, (*ii*) supply of improved breeding stock and eggs at concession rates, and (*iii*) improving the marketing of eggs and ducks to ensure maximum return to the primary producer.

(*d*) State duck-farms and duck hatcheries should be established for the production of improved stock for distribution to public. Exotic breeds like Indian Runner and Khaki Campbell, which do very well under our conditions, and other suitable breeds should be kept at such farms.

(*e*) Little exact knowledge is available about the diseases of ducks at present. Large scale hatchery operations, carried out by the 14th Army in Noakhali district, revealed a fairly high incidence of keel disease in the local flocks. The testing of flocks for this disease should be carried out in different parts of the country with the ultimate object of building up healthy stocks. Other duck diseases and their remedial measures should also be investigated.

(B) *Geese.*

1. *Conditions necessary for successful production.*—Geese are best reared if allowed free range. They spend so much time in grazing on land, that large swimming range

is not required for them, although they enjoy it. Waste lands, where abundant, provide ideal conditions for their production.

2. *Scope for increased geese production in Bengal*—Geese are kept chiefly as pets. They are of little value as egg producers, but are in considerable demand at the X'mas time. According to the report on the Marketing of Eggs in India and Burma (1938), Bengal had some 99,000 geese, which was nearly 45% of the total Indian goose population. Their existing number, and their distribution over the different districts of the province, are not known.

The waste lands of Bengal are already much too overstocked with, and overgrazed by, cattle, and goats. There should, therefore, be little scope for increasing the number of geese in this province without adding to the already heavy pressure on the available waste lands.

APPENDIX IV (2)

(c) Dr. T. W. Millen

Ducks are the most popular waterfowl in India. In Travancore, Cochin and parts of Madras the keeping of ducks is a specialized occupation. I had heard much of the duck farming in Travancore from our students and was surprised to find how rare the duck is in Travancore. I spent days travelling from one end of the country to the other by train and motor and was on the lookout for ducks all the time. I was always in the wrong area or at the wrong season of the year. Finally I saw one or two flocks near the Travancore border and the large government duck farm at Cochin. I agree that these ducks are undoubtedly the progenitors of the Indian Runner duck. The mixed flocks contain white fawn and white fawn, and penciled individuals. With a little selection all the varieties recognized in England and America could be separated out. The nomadic habit of the duck farmers has developed a specialized bird. The average householders in South India is not aware of its possibilities as a back-yard fowl.

In Kashmir foreign ducks have been imported and crossed with the local varieties. Here we find the largest ducks in India and in this state they are a valuable source of meat owing to the ban on beef. Unfortunately, the laying season for the Kashmir ducks is relatively short and it does not correspond to the best time for bringing eggs to other parts of India for hatching.

In the rest of India the ducks are a grand mixture. It is possible to secure all the color patterns known in the West. All our known domestic breeds of ducks except the Muscovy are decended from the wild Mallard so it is not surprizing that the wild pattern is common in ducks bred at random. Several years ago I began collecting all the color patterns available around Allahabad and then started selecting for white eggs, rapid growth and good body size. I ended up with a breed with the wild Mallard or Rouen color and a white breed. Both layed well and the Mallard-colored ones were a little larger. They did not lay quite as regularly throughout the year but made a better table duck. When I purchased ducks for my original flock I had great difficulty in finding any weighing three pounds. By selection I managed to raise some weighing 3½ pounds. In the meantime I secured the loan of six white Indian Runner ducks from imported stock and graded up my white flock. They soon were the best layers of the two breeds and were much more popular than the colored breed so we gave up the latter.

Our present white Indian Runner flock is early Maturing and of high fecundity. One of our customers reports ducks from our eggs began laying ten days before they were five months old and layed an average of 240 eggs each the first year. Ducks in our own flock have layed before they were five months old but we have not kept individual records and our flock is always of mixed age groups. We highly recommend the white Indian Runner for egg production and believe that a flock for these

ducks will lay twice as many eggs as the same number of chickens in India. The world record for egg production is still held by an Indian Runner duck in Australia. She layed 367 eggs in 365 days. On four days two eggs were produced and two holidays were observed.

For meat ducks I would recommend the importation of white pekins from one of the New England duck breeders or one of the American packing firms. These ducks are heavier than Indian geese and are ready for market in 12 to 13 weeks from hatching. Adults of this breed are about three times as heavy as the largest ducks on the plains.

The American Buff Orpington duck or the British kakhi Campbell (or the White Campbell sport) make good dual purpose birds and might be preferable where there is a good demand for duck meat as well as eggs.

Method of Raising and Keeping.—We hatch our ducks in electric incubators and raise them in foster mothers heated by electric bulbs. The ducks are not allowed to go into water until the feathers are plentiful on the breast. We give the ducklings shallow pans of water to play in till they are fully feathered when they are allowed to swim in a small tank. We change the water in the tank daily and keep the fungus from growing on the sides and bottom by the application of copper sulphate or sulphuric acid periodically. All feed is fed in troughs and the ducks are kept at night in welded mesh coops with wire bottoms. From 30 to 35 laying ducks may be kept in a coop 3×6′ and 3′ high provided it has a wire floor. One by two inch mesh wire makes a good floor or larger mesh with one inch woven wire covering it can be used. The ducks lay most of their eggs between 4 and 7 a.m. So a reliable man has the key and his first duty each morning is to release the ducks and gather the eggs. A two-foot fence confines the birds but we usually use a three foot fence to keep out dogs also. We keep one drake to six ducks in large flocks, so many drakes are available for food purposes. When clean stock is kept on well drained ground and the ducklings do not come in contact with birds until they are fully feathered, few die, of disease. About one third of the food given should be chopped green forage. We use blood meal and curd made from skim milk for the required animal protein.

There is no more economical converter of grain into meat than a good Pekin duck nor a better egg machine than an Indian Runner duck.

The Muscovy duck is popular with some but we have given up this breed. They require 35 days to hatch instead of the 28 days required by the other breeds. Also they are seasonal in their laying and do not lay as many eggs. They are quite economical to feed. The Muscovy can fly and must have one wing clipped if it is to be confined in a low pen.

There is a considerable prejudice against the use of duck eggs for food among certain sections of the population. In one class, I was conducting, I found one man who was sure that eating duck eggs would cause blotches on the skin. Another member of the class told of the prescribing of duck eggs by an Ayurvedic doctor for the removal of skin blotches. There should be propaganda of a positive type showing the food value of duck eggs and telling ways of using them. We should discourage the keeping of ducks in sewage drains and the use of raw duck eggs. The 'keel' disease of young ducklings is acquired in the adult stock from the sewage, transmitter to the ducklings through the egg. Man may contract a type of paratyphoid from taking eggs raw that contain the organism Salmonella anatum.

We feel that all poultry keepers should be encouraged to keep improved duck. The duck requires only enough water to slake its thirst and clean its beak. The water should be kept enough for the duck to immerse its head.

A brick and cement tank 3 feet by 6 feet, one foot deep will be large enough to keep up to 540 are more ducks happy provided the water is changed regularly. Always build the tank above the ground level so that the fouled water can be drained away. Plenty of broken bricks should be kept around the tank so that the ducks will not play in mud puddles. My practice was to keep the duck pen and tank at the end of my garden. The tank was filled with a hose and the water used to irrigate a row of papaya trees all around the garden. The ducks were happy, the papaya trees were luxuriant and the papaya leaves, seeds and waste pulp were turned into table eggs and meat.

The villagers in this area purchase duck eggs for hatching at such a time that the ducklings are ready to swim in the village ponds during the monsoon. Most of the ducks food is thus provided free until the pond dries up when the ducks are sold. It would be well to supply month-old improved ducks to the villagers at reduced rates during the monsoon.

Geese.—We have had less success with geese in India. So far we have tried only the common Indian or possibly more correctly "Chinese" goose. These birds are very small when compared to western breeds and there is considerable difference between the sizes of the two sexes, as is the case with the Muscovy duck. The goose is a grazing bird and the young goslings require greed feed from hatching. If plenty of pasture is available, geese can be kept economically but they are expensive to feed in a pen. The goose egg takes 30 days to incubate, requires a lot of space under a hen or goose or in an incabator. Few eggs are laid by Indian geese. The goose eggs at our farm have a high vapour tension. Because the goose lays at any time of day or night the female must be kept locked up all day to prevent pilfering of the eggs. More males must be kept than for ducks. Older ganders tend to pair off but if young ones are used, two geese may be kept with one male. I cannot recommend the universal keeping of geese and would not expect the commercial farming of Indian geese to be possible. There is a great deal of difference of opinion on when a goose lays her eggs in the U.P. Some say February, others say October. I find that both are right. Some geese lay only in February and others only in October and some in both seasons. I think some effort should be made to try out foreign geese both bred pure and used to grade up indigenous stock.

APPENDIX IV (2)

(*d*) Dr. J. K. Makhijani (Livestock Officer in Sind) and S. V. Chandiramani (Senior Lecturer, Agricultural College, Sakrand).

General Introduction.

Among the gallinaceous birds, we have the land fowls and the water fowls. The latter are short legged and web-footed, and some of their domesticated members have been found suitable for both egg and meat production, for culinary purposes. Of these, swans, geese and ducks belong to the family ANATIDAE.

SWANS are the largest birds and have the longest necks. They are very graceful swimmers and belong to the sub-family *Cygninae*. They are not important for egg or meat production.

GEESE are the next in size. They are in many respects intermediate between swans and ducks. They differ from the ducks in that the sexes are feathered alike and the male assists the female in rearing duties. They belong to the sub-family, *Anserinae*. Geese are herbivorous and extensively migratory. When forced to it

they fly strongly and in V-formations. Their rearing is extremely profitable. Housing and feeding cost is negligeable. An ordinary thatch-work protection from storm and heat on high dry and sandy ground is however needed, though, in the open, the birds do well in any marshy surroundings. They eat up grass, and need large grazing range, birds go out and forage for themselves during the day and return easily at night. Any bad land with grass will do for them. They will thrive where cattle may starve and will heavily fertilise the land with their droppings and improve it. They are very hardy and breed to 20 or even 40 years age. Nesting is in grass or straw in clutches of 6 eggs. To fatten easily, restricted foraging and trough feeding are necessary. Among the 9 domesticated varieties, the Emden and the Toulouse are the best breeds. The latter is the better layer (35 to 100 eggs) per year, and being the heavier (adult male weighing 30 lbs.) is also the coarser in flesh.

DUCKS are smaller than swans or geese. The two sexes can be distinguished by plummage differences. In the United States of America, they are mainly used for the table but in England and Holland fine laying breeds have also been developed. Ducks belong to 3 sub-families, *viz.*, Anatinæ, Fulingnlinea and Mergansers. The important duck-breeds are :—

(1) Indian Runner (essentially egg breed).
(2) Buff orpington (dual purpose breed).
(3) Khaki Cambell (a fine layer, like the runner).
(4) Pekin (for meat).

Duck Industry Abroad.

During the past few decades, the duck Industry has just about held its own. In the United States of America, it has been restricted to meat production only, as the ducks are specially adapted for this on account of their rapidity of growth hardiness, ease of handling, housing, etc. For these reasons intensive duckfarming has been more successful than intensive chicken raising. But duck raising. as business, is restricted, because the demand for duck meat is not so steady nor its popularity so great as for chickens. Duck meat is dark, and the percentage of edible muscle meat is not so large as in the chicken. Also the keel is flat and boatlike unlike the chicken. Pekin is the most popular breed (adult male weighing 9 lbs.) in the United States of Ameriaca, but Aylesbury (adult male, 10-12 lbs.) is preferred in England

In England and Holland, however, the water fowl industry has done better. There are good breeds both for meat and egg production. In the past the quality of the duck eggs has not been in great favour due to stronger flavour and yellower colour. Lately this prejudice has decreased, as it has been possible to markedly diminish these off-points by avoiding stagnant pools and materials which impart bad flavour, by adopting proper breeding. The war however has served to decrease the popularity of ducks, as their voratious feeding habits could not be easily satisfied due to shortage of the grass lands and feeds.

Scope in India.

The entire poultry industry in India needs a good push. The ducks can perhaps be pushed more easily here than abroad, because the competition from the land fowls is not of a serious nature as in the west. Available statistics on Indian Poultry indicate a very heavy natural economic preference for duck raising. The average country hens annual yield of 53 eggs weigh only 5 lbs. against the 12½ lbs. weight from the average animal production of 90 eggs from ducks. Add to this the tremendous safety and ease in duck rearing, and the incapability of the illiterate Indians who

handle the bulk of this industry, to afford or understand the modern methods of rearing and management. The raising of these hardy and thrifty ducks and geese for their eggs and meat, tends itself to more profitable operation than the more susceptible chicken.

Suitable Areas in India.

Duck and geese distribution in India is mostly on the eastern coasts and rivers estuaries thereon. Sind, Kutch, Kathiawar have large coast lines but have negligible number of these birds. Inundation lakes which are more or less permanently under water and almost all over the Barrage areas in Sind and other irrigated areas in the country, where water is almost always available in the canals, are other suitable places for raising ducks, etc. There is also some sort of vegetation to be run over by duck and geese.

Steps to encourage the industry.

A Government colony of ducks and geese may be established in convenient places and private enterprisers encouraged to devote part time or full time attention to this industry as their efforts will be well rewarded by the markets like those at Karachi and other places. Runners and Cambells may be tried at the first instance. There appear better chances of the industry succeeding on part time basis. Once the fancy of the public is caught, the Government farms will have quite a time in meeting with the demands of these water fowl men. The chances are that there may develop a good permanent demand in the cities for these water fowls which could also be kept without much water. The farmers who are now keeping land fowls might soon show preference to water fowls with good profit. Eggs will be more and larger and deaths will be fewer.

APPENDIX IV (2)

(e) By Z. A. Hashmi.

India is one of the major duck raising countries of the world. It is estimated that out of the total world domestic duck population, some 16 per cent lie in this country. There are in India 1,66,00,000 ducks, which lay nearly 516900000 eggs annually or contribute approximately 15 per cent of the country's total egg production. Manifestly, the breeding of ducks is already a sizeable industry in the country.

Scope for increased production.

Curiously enough, no effort has been made to ascertain the capabilities of this profitable bird, nor any attempts have been made to improve the conditions of its breeding and management. This neglect has not been due to any lack of appreciation of the great nutritional importance of eggs, or of the need for their increased production to supplement Indian diets, most of which are greatly deficient in foods of high biological value. It has its origin, probably, in the belief that the duck and the hen serve the same purpose and it is wasteful to retain two, species where one might do. Consequently efforts at increased production of eggs have been restricted in the past, almost entirely to the improvement of the hen. There are evident fallacies in this standpoint, as the great abundance and concentration of the duck population in the south and east of the country, indicate that there are vast areas peculiar suited to the breeding of ducks, where neglect has been effectively counter-balanced by natural advantages. The need for greater attention to this useful bird will be evident from the following considerations.

In the raising of any type of livestock in this country, the disease question is one of the main deciding factors. This is particularly so with poultry keeping. It has

been estimated that roughly 33 to 50 per cent of laying fowls have to be replaced every year as a result of heavy mortality. The huge loss to the country can be easily visualized when it is considered that the number of laying fowls in India is 522 lakhs. The mortality is due to a number of causes but contagious diseases are undoubtedly the major factor. Of these Ranikhet disease is admittedly the most destructive. Fowl-pox comes next in importance, because of its country-wide distribution and perennial occurrence. Experience with fowl diseases has shown that, while reliable preventives may be available, the absence of an adequate organization and personnel for effective application nullifies their value. The duck, therefore, has its peculiar usefulness, when it is considered that it is naturally resistant to Ranikhet disease and fowl-pox. Authoritative estimates about the relative number of eggs retained for hatching from the two species also, indicate a much lesser mortality in ducks. Only 9·3 per cent of duck eggs compared with more than 20 per cent of fowl eggs are retained for hatching to replace losses. Comparatively a much larger number of duck-eggs are, therefore, released into the market.

The Indian duck is also a prolific layer. Its average annual production is 90 eggs and that of the *desi* hen 53 eggs. In Burma the corresponding estimates are 180 eggs for the duck and 40 eggs for the hen. The Burma duck, which is better managed and cared for than its neighbour in India, produces in weight as much as six times the amount of egg produced by the Burma hen. In many areas in India the average production of ducks is said to be 120 eggs and there is no doubt that the Indian duck could give much better performance with improved breeding and management. Even as it is, ducks constitute 10 per cent of the laying poultry, but contribute 15 per cent of the total egg production in the country. The egg-size is also much larger, the respective weights for 100 duck and 100 hen eggs being 13 lb. 11 oz. and 8 lb. 5 oz.

Duck breeding in India is further characterised by the relatively large size of duck flocks, the number of ducks per flock in certain areas of concentrated production being 500 to 1500 birds. The produce is thus usually available for marketing, and duck raising is consequently a more or less commercialized concern. The bulk of the fowl population, on the other hand, is maintained in very small units, dispersed on countless holdings. They are left to themselves to eke out a precarious living, the owners scraping together the little produce which comes virtually gratis. The collection and marketing of produce is, therefore, easier in duck raising areas. Further the duck-flocks being the means of their livelihood, the owners are more keenly interested in their well-being. There is, therefore, abundant scope for the improvement and organisation of such flocks.

An incidental though none-the-less important advantage in increasing the number of ducks in areas of heavy rainfall, is the role of ducks in keeping down the snail population, thus reducing losses from liver-fluke disease in goats, sheep and cattle. This disease is admittedly the most serious of worm infestations in water-logged areas. Work done in Australia, U. S. A., Yugoslavia and other countries indicates that ducks are a valuable means of controlling this disease. Such areas are, incidentally ideally suited for the breeding of ducks.

Area of Production.—Unlike the fowl, which thrives equally well in many parts of the country, the duck is definitely more sensitive towards its environment. It is at its best in areas of heavy rainfall, where it has free access to mud and water. It has, therefore, a decidedly regional distribution, being confined almost entirely to the east and south of India, mainly on Travancore, Madras and Bengal. Efforts at its improvement should, therefore, be primarily concentrated in these areas. There are, however, areas in the country e.g., parts of Bombay, where natural conditions

are suitable but the duck population is sparse. Here habit and tradition are the main barriers to their propagation. Attempts should be made to introduce the raising of ducks in such areas. These must naturally be preceded by small-scale experimental trials to gain experience of local conditions. Duck breeding could also be introduced successfully in selected localities in many other parts of India. There are e.g., nearly eight thousand tanks in eastern and southern Rajputana, which is well-watered and well-wooded. These vary from one square mile to ten square miles in area. Besides, there are big artificial lakes, like Jaismand in Mewar which has an area of 20 square miles. On one such small tank near Ajmer the military authorities have a flock of ducks which has been laying splendidly, showing that the breeding of ducks can be undertaken with advantage around these tanks. There are at present only 4895 ducks in the whole of Rajputana, although at least 160000 ducks could be maintained practically on free range, on the 8000 tanks in eastern and southern Rajputana which would provide nearly 4000000 eggs every year.

Steps necessary to encourage duck breeding.

1. A really successful industry can only be based on sound knowledge of fundamentals. A survey of the country for the selection of the best indigenous types, work on the establishment of varieties suitable for different areas, setting up of feeding standards based on the requirements of these birds under Indian conditions concordant with the availability of feeding-stuffs in the country, studies in the physiological response of ducks to different environment and work on the means of adapting them to the varying climatic conditions, survey of the common duck diseases and the elaboration of methods for their control, are all pre-requisites to the successful organization of the duck industry. A commodity research station or sub-station, situated in a duck breeding area to undertake work on the above problems is, therefore, a basic need.

2. Regional duck farms are needed to serve as nucleus for duck husbandry in each area. These farms should supply breeding stock, hatching eggs and day-old ducklings to breeders, on approved lines.

3. Ducks should receive due share of attention from State agencies responsible for poultry development. The establishment of demonstration duck farms, the inclusion of classes for ducks in poultry shows, and the provision of assistance, advice and marketing facilities to breeders of ducks should be arranged for. The co-operation of the extension staff of the Animal Husbandry, Agriculture, Co-operative and the Marketing departments will be essential to ensure full benefits to duck-breeders.

4. Impetus for increased production will, however, depend ultimately upon the demand for eggs. There is evidence of increased consumption of eggs in the educated classes and in urban areas but an over-whelming majority of the population has no realization of the great food value of eggs. It is a national need to launch a diet-reform campaign, particularly to ensure the inclusion of alternative protective foods in the diet of landless classes who can neither afford to keep cows nor buy milk. This can be done by assisting these classes to take up poultry keeping. This will also be the corner-stone of a national poultry industry. For more rapid expansion hope, however, has to be placed in developing an export trade. It may be difficult to capture markets for fresh eggs but the supply of frozen or liquid eggs, yolks and albumen and egg-powder etc. offers a lucrative trade. The establishment of factories for these products in areas of concentrated production are highly desirable. Duck-husbandry will lend itself admirably to such demands for it is already more or less commercialised concern.

APPENDIX IV (3)

(*a*) A NOTE ON THE USE OF TREE AND BUSH FODDER IN INDIA EXCLUDING PUNJAB AND SIND BY A. P. F. HAMILTON, O.B.E., M.C., I.F.S., INSPECTOR-GENERAL OF FORESTS TO THE GOVERNMENT OF INDIA.

It is not possible to give any figures which would indicate the extent to which the lopping of trees and bushes supplements the normal fodder ration of Indian cattle. Customs and usages vary largely from place to place and in some areas the lopping which is practised is mainly by nomadic herds. Speaking very generally the feeding of gramnivorous animals on the loppings from trees or bushes is an abnormal feature; it is, however, a widespread habit in India and in some localities even a necessity.

The fundamental reason for this practice is the ever-increasing pressure on the land by man and his animals. Even in years of normal production in field and grass-fodder crops the amount of fodder available is below the amount required to keep the livestock in a normal condition of health and strength.

It is a popular belief that the forests and waste lands in India can provide ample grazing for the herds; this belief is entirely wrong. The grazing incidence is in general probably one of the highest in the world. In the Central Provinces it is estimated that on an average there are roughly 1·5 acres of grazing land per head for domestic animals. In the United Provinces out of the 39 million cattle enumerated at the last census only about 1·5 million are so situated that they are able to graze in Government forests. In addition to this not only is the country, or parts of it, subject to periodic drought but even in normal years a prolonged dry season from October or November to the break of the rains is a normal feature of the climate. As a result of this the value of the grazing is reduced to a very low figures by the time the hot weather begins. In addition to all this the actual production of grass per acre of the palatable species is generally low due to a number of causes such as bush growth, rockiness of the ground and over-grazing.

As a result of the factors indicated above the necessity for lopping for fodder emerges, and this lopping is practised mainly during the season when the grass is dry and the trees are putting out fresh leaves, *i.e.*, during the spring. If sufficient grazing, grass, and cultivated fodder were available, the villager would be unlikely to put himself to the extra trouble of lopping except in the case of those species of tree or bush the leaves of which are known to have the special quality of improving milk. Things being as they are, however, tree and bush fodder must be considered as being of very considerable economic importance to the villager; for fodder famines will continue, when the trees and shrubs may provide the almost only source of fodder in some localities; and unless and until something in the nature of a revolution takes place the grazing grounds will continue to be over-grazed.

The Forest Department has naturally been unfavourably disposed to lopping since the practice has resulted in the destruction of the natural cover of the ground to a greater or less extent in many parts of India; but it is now recognised that tree fodder can play such an important part in rural economy, particularly in years of scarcity, that steps must be taken to do what is possible to increase the supplies along with the adoption of other measures designed to improve grazing and the production of crop fodders, straws, etc.

Measures to increase the supply of fodder from lopping would not include the opening of reserves to unrestricted lopping, but they would aim at controlling the utilisation of existing tree growth in such Government forests as lopping is already

allowed by means of rotational lopping schemes. The fact must, however, be faced that it is exceedingly difficult to persuade villagers who have rights of lopping to agree to such rotations and it will be only through prolonged and patient effort that success will be finally achieved. But the plan which is likely to be most fruitful and in which the villagers themselves are most likely to co-operate is the establishment of fuel and fodder plantations on the waste lands which abound in this country. All Provinces have in their post-war reconstruction plans schemes of this nature, though such plans may not be applicable everywhere because there are large tracts of country which are so heavily cultivated that practically no waste land exists; in such cases something can be done by the encouragement of the planting of trees along the edges of the fields, round wells and on small patches of unused land which are of common occurrence.

It is a fact that almost everywhere where trees are the personal property of the Zamindar he will lop them in such a way that they will not die but will provide him with a sustained yield of fodder: it is in the Government Forests which are under rights of lopping and which are, as far as the villager is concerned, nobody's care, that trees are lopped to destruction. Apart from the question of introducing rotational lopping in such forests, a matter which I have already referred to, the inference is that prospects of future development and improvement lie in increasing the number of fodder-producing trees which are either collectively or individually owned by the villager and it is to this and that rural reconstruction afforestation plans must be directed.

The privately owned forests are also a source of supply for lopping. In most provincial administrations bills for the protection and improvement of these forests, which have been grossly mismanaged in the past, have either been introduced or are under preparation; the schemes of management which will be prepared for these forests will, it is hoped, introduce measures for the safeguarding of fodder trees and for the production of leaf fodder on a sustained yield basis.

Other important measures which would help to ease the fodder situation and which would have a direct or indirect effect on lopping are:—

(*i*) A sound water and soil conservation policy in all dry districts; this would increase the quantity of roughages from cultivated land, and on uncultivated land the production of herbage including trees and shrubs would be greatly increased.

(*ii*) The storage of surplus monsoon fodder including loppings to provide a reserve for the dry season.

(*iii*) The mixing of green-leaf fodder with dry straws when passed through the chaff cutter. This can be done even with thorny species the leaves of which are otherwise uneatable owing to the presence of thorns.

(*iv*) In the United Provinces *taungya* plantations have been made in the Saharanpur Division in which the main object of management is to provide species for lopping by the local villagers under a rotational scheme and there is no doubt that similar land management can and will be followed in many other parts of the country.

The importance of including schemes for the production of leafy fodder in post-war plans cannot be overestimated. Operations under the Land Development Bill in Bombay include the planting of fodder trees and in particular *anjan* (*Hardwickia binata*) on all land which is unfit for cultivation and the growing of such trees on the countour bunds is also being encouraged. Conversely this example may be used

as an argument in favour of the adoption of detailed local plans for rural development, for in no other way would it have been possible to get these trees on the ground over such extensive areas and in such a short period of time.

To what extent the supply of fodder from trees and bushes can be increased during the coming years, it is quite impossible to predict; all that can be said is that if the plans of the Provincial and State forest departments for increasing the area under forest, and in particular to develop village and "farm" forestry, are implemented, there will undoubtedly be an increase in the potential supply.

A few notes on lopping practice in some of the Provinces are given below as a matter of interest: *Central India and Rajputana.* The tree known as *dhaukra* or *hardahi* (*Anogeissus pendula*) provides excellent fodder, but it is a small tree and the cattle browse it without lopping. In famine years it is a great stend-by. As in the Central Provinces *dhak* (*Butea frondosa*) much prized in the Punjab, is scarcely lopped at all. In Western Rajputana *mesquite* (*Prosopis juliflora*) is likely to be widely propagated under afforestation plans, and the pods, which are an excellent fodder when green, must be popularised.

Bengal.—In the Himalayan and *sub-montane* region the demand for fodder is great and lopping is wide spread. Here there is scope for the Forest Department to form "lopping" plantations. Something has already been done in this direction, but it appears that something more definite is required. In the rest of the Province there is little demand for loppings.

Bihar.—It is stated that lopping is little practised in Bihar.

Bombay.—The measures to increase leafy fodder in the Deccan have already been mentioned. Outside the forest areas there is much indiscriminate lopping for goats and camels, for cattle lopping is confined mainly to localities where stall-feeding is commonly practised, except in famine years when it may be resorted to everywhere.

"*Anjan*" *Hardwickia binata* is the most useful fodder species and is the only one which has actually been propagated as a fodder-producing tree. Orders have been issued by Government that this tree is to be sparingly cut.

Central Provinces.—In the rice-growing Chattisgarh plain the grazing areas are situated on poor soils, giving low-grade grass. Fodder plantations would be of real value. In the wheat tract in the north grazing improves; but there are large tracts of *kans* infested land which could be used for growing fodder and fuel plantations. In the cotton tract of Berar stall-feeding with *karbi* is widely practised; green tree-leaf fodder would be useful for mixing with dry fodder in the hot weather, and here again fodder plantations would be beneficial.

Madras.—Generally speaking lopping is practised in scarcity years, but round Government reserved forests where scrub cattle concentrate and waste lands have been broken up for cultivation the shortage of grazing compels lopping.

The bamboos are extensively lopped in some localities in scarcity years.

Orissa.—The chief trouble is the coastal plain which is subject to frequent inundation during the monsoon. What is required is the propagation of species which will withstand the inundation and at the same time provide fodder; investigations are proceeding.

The United Provinces.—In the hills leaf fodder plays a special part in the upkeep of livestock; the hill grass outside the alpine areas provide poor grazing and

the yield of palatable grass is low. The oak and other species must be protected against destructive lopping as the existence of the people depends on a perpetual supply of leaf-fodder.

In the plains great scope exists for the extension of fuel and fodder plantations with or without *taungya*, and plans are already under way.

APPENDIX IV (3)

(*b*) By M. D. Chaturvedi, B.Sc., (Oxon), I. F. S., Conservator of Forests, U. P.

Summary.—During winter, when grasses turn tough and gradually become inedible, cattle must turn for their sustenance to alternative sources of forage, the least valuable of which is leaf-fodder. In the Gangetic Basin, where 70 per cent of land is ear-marked for agriculture, the fodder scarcity is acutest. In the intractibility of *usar* (saline) soils, which amount to just under two million acres, suggestive of Nature's limit to the all-devouring agriculture, lies the only hope for the creation of fodder reserves for the cattle of this region. Regulated cattle incidence with the monsoon closure, accompanied by the planting of leaf-fodder trees in pockets of good soil free from calcareous deposits, is all that is needed for converting most of these desolate wastes into fair pastures. *Bhur* (sandy) soils in Rohilkhand and ravine lands along the banks of the Jumna and other steams similar opportunities. The management of treelands for sustained leaf-fodder supplies is based on the principle of ensuring the necessary respite for trees to recoup the temporary damage caused by the partial stripping of their leaves. A rest of two growing season is the minimum prescribed. The lopping of saplings and young growing shoots in the upper 1/3rd of the tree crowns is prohibited, as it inhibits the development of trees. On no account should young succulent leaves be allowed to be stripped in spring; their toxic nature is Nature's device to protect them.

Domestic animals represent the keystone of the economic structure of the rural areas in the United Provinces. Bullocks and buffaloes constitute the mainstay of agriculture which is the chief occupation of the vast bulk of population inhabiting about a hundred thousand villages dotted over the length and breadth of these Provinces. Tractors and other mechanical contrivances being beyond his reach, the Peasant is content with eking out a living with his age-long plough and bullocks transport along rough and ready village roads is still largely dependent on animal traction in which bullocks, buffaloes, horses, mules, donkeys and camels play their humble role. Cows and goats, apart from yielding milk and other dairy products also provide meat for human consumption.

2. Domestic animals subsist on concentrates and roughage. Concentrates consists of oil-cake, cotton seed, gram and by-products of agriculture. Their availability is dependent upon the resources and outlook of owners towards their cattle. Roughage is derived largely from grasses, weeds growing on fallow and cultivated lands, fodder crops, stubble, chaff and leaf-fodder.

3. As factors of locality vitally effect the type of grazing available, it will be convenient to deal with the fodder sources of these Provinces in different natural regions as suggested by their physical features. These are—

	Area (sq. miles)
1. The Himalyan Tract.	14,959
2. The Gangetic Basin.	76,413
3. The Central India Plateau.	14,875
Total.	106,247

The configuration of these tracts is so variable and soil conditions so different that it is necessary to consider them separately.

4. The livestock return of these regions stood at the census taken in 1944 as under:—

Livestock	Natural Regions			Total
	Himalayan tract	Gangatic basin	Central India Plateau	
	Thousands	Thousands	Thousands	Thousands
1. Cows, bulls etc.	425	18,268	2,404	21,097
2. Buffaloes,	90	7,849	585	8,524
3. Sheep goats, pigs etcs.	128	7,365	1,081	8,574
4. Others	11	598	42	651
Total	654	34,080	4,112	38,846
5. Cow-units	679	38,247	4,156	43,082

The term " Others " includes horses, ponies, mules, donkeys and camels. Cow units are obtained by equating one cow to 2 goats or sheep, one bullock, horse or pony and 1/2 a buffalo. Figures for the Himalayan Tract deal with the Naini Tal *tarai** and *bhabar** and the Dehra Dun district. No information is available for the hills.

5. Before considering the general problems relating to the feeding of the livestock population referred to above, it will be worthwhile examining the truth of the oft-repeated assertion that the bovine (cows and buffaloes) population is far in excess of the requirements of these Provinces. The cattle and buffalo stock correlated with the population and area under cultivation in different natural regions of these Provinces will be found instructive :—

Region	Population 1941	Area under cultivation	Work animals over 3 years	Breeding males	Milch animals	Useless animals	Young stock below 3 years
	Millions	Mil-acres†	Thousands	Thousands	Thousands	Thousands	Thousands
Himalayan Tract	1·85	877	140	2	210	4	159
Gangatic Basin	49·72	32,140	9,893	17	8,382	146	7,679
C. I. Plateau	3·45	4,203	871	8	1,129	25	957
Total	55·02	37,220	10,904	27	9,721	175	8,795

6. From these figures emerges the startling fact that far from being in excess the bovine stock is hardly sufficient to cope with the agricultural requirements of

*The detritus deposits at the foot of the hills are known as the *bhabar*, a waterless tract which tails down to the *tarai* abutting the Gangetic alluvium. Hill streams which disappear in the vast porous mass of bhabar debris rise again in the *tarai* characterizing it as moist and malarious.

†Milacres stand for a thousand acres.

these Provinces. Thus, there is one work animal for every 6·2 acres of cultivation in the Himalayan Tract, 3·25 acres in the Gangetic Basin and 4·8 acres in the Central India Plateau.

This is far from being sufficient, more particularly, if the inefficiency of the ill-bred cattle of this region is remembered. The position of milch and breading animals is even worse. There is only one cow or buffalo for 9 persons in the Himalayan Tract, 6 persons in the Gangetic Basin, and for 3 in the Central India Plateau. The recent depredations into the livestock population of these Provinces to feed the Army and prisoners of war have been reflected in the above table. The position was a little better before the war. The bovine population of these Provinces stood in—

	Millions.
1924-25	31·046
1944-45	29·621

7. Adverting to the question of the fodder resources of these Provinces it might be generally observed that during the four monsoon months (June 15 to October 15) when grasses grow plentifully, vigorously and ubigutously, there is no fodder problem any where in these Provinces. During the monsoon, grasses are luscious, have high nutrient contents and maintain livestock in good condition. The winter season, October 15 to February 15, is generally characterized by low temperatures, occasional frost and generally limited precipitation. Conditions such as these are hardly conductive to the growth of grass which practically stops with the cessation of monsoon. As the cold season advances, grasses become increasingly tough and unpalatable and eventually useless as fodder by the onset of summer. At the same time their nutrient contents fall and cattle must need turn to an alternative forage. By April, the great majority of grazing grounds in the plains, are practically bereft of all green vegetation and continue a desolate existence unrelieved throughout the summer. The forlorn cattle wander far and wide in search of food and eke out a miserable existence. The break of the monsoon (middle of June) turns the sun-scorched grazing grounds once again into green pastures which secure a fresh lease of life to skeletons euphemistically described as live (!) stock.

8. Indian conditions and traditions being against the storage of grass as hay or silage, cattle must depend for about six months in the year on leaf-fodder and by products of agriculture supplemented by green fodder crops. Tropical heat seasonal rain and a continental winter render the British conception of gorgeous downs with lush grasses foreign to these Provinces except in the hills which enjoy a temperate climate. The universal complaint regarding the comparative lack of pasture lands loses much of its point, if it is remembered that the extension of land under grazing grounds will provide during the winter and summer season only a false sense of security and little food. Grazing during the dry summer months, except in moist localities such as river and *nala* banks and the *tarai* where cattle migrate, is even worse and the so called pastures provide nothing else but exercise.

9. The ideal plan for the fodder supply in these Provinces should take the following course :—

Moonsoon	Grass only.
Winter	Grass plus leaf-fodder.
Summer	By-products of agriculture,

supplemented more particularly during the cold and dry hot weather by concentrates and cultivated fodders like lucerne (*Medicago sativa*) berseem (*Tritelium*

alexandrinum), Guinea grass (*Panicum maximum*), Japanese millet (*Panicum crusgalli*) and the indigenous *juar* (*Sorghum vulgare*). The possibilities of introducing hay and silage as cattle food need further exploration. It will require both propaganda and demonstration to overcome prejudice against silage.

10. Leaf-fodder, it will be seen, plays an important role during the winter months only, when its nutrient contents are high. While browsers like sheep, goats and camels subsist on leaf-fodder right through the year, the bovine population (cows, bulls and buffaloes) amounting to about 30 millions might also be provided with leaf-fodder as an alternative forage to grass which turns inedible during the latter part of the winter. The value of pasture lands will therefore be considerably enhanced if they are planted up with leaf-fodder trees. The ideal stocking to be aimed at is an average of about 12 to 15 trees to each acre of grazing ground. Where soil is variable, as in *usar* (saline) lands, treegrowth will have to be confined to pockets free from calcareous pans underneath. Groups of trees dotted here and there will provide food for cattle during winter and shade during summer.

11. By far the best leaf-fodder species for the plains are in (*Azadirachta indica*) and *saunjna* (*Moringa pterygosperma*) which are noted for their adaptability and ease in propagation. Seed dribbled during the rains in specially prepared patches *inside* thorny bushes yields the best results. Thorns which persist even in the driest localities provide a natural live fence and act as a veritable nurse for the young seedlings protecting them from cattle, goats and the worst of all enemies, porcupines.

Other leaf-fodder species typical of various natural regions, meriting special notice are :—

I. Gangetic Basin :—

1. *Acacia arabica*, specially pods. *Babul.*
2. *Bauhinias* (Sp.). *kachnar*
3. *Ficus glomerata*. *Gular.*
4. *Ficus religiosa*. *Bargad*
5. *Morus alba*. *Tut*
6. *Tamarindus indica*. *Imli*
7. *Zizyhus jujuba*. *Beri.*

II. Himalayan Tract :—

1. *Anogeissus latifolia*. *Bakli*
2. *Bauhinia* (Sp.). *Kachnar*
3. *Grewia asiatica*.
4. *Grewia tiliaefolia*.
5. *Lannea grandis*. *Jhingan*
6. *Melia azedarach*.
7. *Morus alba*. *Tut*
8. *Oligenia dalbergioides*. *Sandan.*
9. *Poertcarpus marsupium*.
10. *Quercus incana*. *Banj*
11. *Quercus* (Sp.).
12. *Sterculia pallens*.
13. *Stereospermum suaveolens*.
14. *Terminalia tomentosa*. *Asna*

III. Central India Plateau :—

1. *Anogeissus pendula*. *Kathdhai*
2. *Bauhinia* (Sp.). *Kachnar*

3. *Tamarindus indica. Imli*
4. *Terminalia tomentosa. Asna*
5. *Zizyphus jujuba. Beri*

12. The growing importance of leaf-fodder in comparatively recent years has determined the choice of species in plantations in the reserved forests and elsewhere in the plains. *Nim* is now freely being introduced in the Jumna ravines for the purpose.

13. Investigations on the determination of the nutrient contents of various leaf-fodders in collaboration with the Animal Nutrition Section of the Indian Veterinary Research Institute at Izatnagar are still in progress. An analysis of the leaf-fodder samples of a few typical species reveals their nutrient contents as under :—

Species	Percentage Composition on Dry Basis × 100.							
	Ash		Crude Protein	Fibre	Nitrogen free extractive	Crude fat	Lime (Cao)	Phosphates (P2 O5)
	Total	Soluble						
Adina cordifolia ..	793	752	1,526	1,269	6,019	393	241	26
Bauhinia variegata ..	854	798	1,315	2,937	4,082	212	340	42
Morusalba ..	1,380	780	1,309	1,671	4,970	680	274	45
Average of 5 typical U. P. grasses.	1,065	293	453	4,556	4,818	109	53	40

It will be seen that compared with grasses, leaf-fodders of the above species are exceptionally rich in such essential nutrients as crude proteins, nitrogen free extractives, crude fats and lime. The absence of data pertaining to the digestive trials of these leaf-fodders renders generalisation regarding their comparatively high nutritive value difficult. It is suspected that the presence of tannins adversely affects the availability of leaf-fodder proteins in the metabolism of animals. It may, however, be stated that the nutrient contents of these leaf-fodders compare favourably with young lush grasses and green leguminous forages noted for their nutritive value. The condition of gujars' buffaloes living practically on leaf-fodder only during the winter season provides an eloquent testimony of its food value.

14. The management of treelands for sustained leaf-fodder supplies should follow the technique developed in the Saharanpur Siwaliks during the last 15 years. The basic principle underlying the lopping regulations in the Saharanpur division and elsewhere in the reserved forests is to ensure the necessary respite for tree to enable them to recover from the temporary damage caused by the partial stripping of their leaves. It has been observed that trees carefully stripped during winter usually recover at the end of a single growing season. For, after all, partial stripping of practically functionless leaves during winter, which are heading for a fall in any case, cannot do any permanent harm to treegrowth. Under no circumstance, whatever, should stripping of new leaves be permitted in spring. The toxic properties of fresh leaves is nature's device to protect them.

15. To provide immunity from any likely damage to the growth of trees caused by careless lopping of young branches, a rest of three growing season has been generally prescribed. During recent years when the jungle warfare training in the

Siwaliks reduced the areas available for lopping, the rest period was reduced to two years without any deleterious effect on tree-growth. The salient features of the Saharanpur lopping scheme are given below :—

(1) certain valuable species are declared as 'protected' from lopping.

(2) no lopping is permitted in areas liable to erosion, where all vegetation is carefully nursed up.

(3) saplings and small poles are not permitted to be lopped.

(4) the upper one-third of the crown of all trees is protected from lopping. Branches over 3 inches in diameter in the lower two-thirds of the crown may not be cut.

(5) A cycle ensuring two growing seasons complete rest is prescribed.

16. Most privately owned treelands are subjected to un-restricted lopping. *Nim* is generally lopped to death and even roadside avenues are stripped naked of their leaves. Goat herds attended by a man going about with a sickle attached to a bamboo pole is a common sight along the main thoroughfares in these Provinces. Trees react to continuous lopping by adopting a stag-headed appearance and reducing their leaf surface to the barest minimum.

17. For a correct perspective of the fodder situation in these Provinces, the following analysis by natural regions will be found instructive.

(i) The Himalayan Tract.

18. In the hills, the precipitous nature of the ground acts as a limiting factor over pastures. Level land is difficult to come by for agricultural purposes, much more so for grazing grounds. Grazing of sorts is, however, available in the reserved and civil forests, the configuration of which compels villagers to cut grass and stall feed their cattle. The cultivation of fodder crops is practically unknown due to the scarcity of land, and livestock has to depend very largely on leaf-fodder, cut-grass and by products of whatever agricultural crops are raised. The role of leaf-fodder in the maintenance of cattle in the hills, therefore, can scarcely be over emphasized.

19. The management of forests in Kumaon, more particularly, the control of lopping led to a widespread agitation in the past, culminating in the appointment of a Forest Grievances Committee which examined the entire forests administration in Kumaon in 1921. Thereafter, the Kumaon forests were managed in accordance with the recommendations of the Committee. Vast oak forests, over which liberal [illegible] ions were granted, had been lopped to death by 1939 when the position was reviewed, resulting in the stiffening of restrictions over lopping. The general principles underlying the restrictions on lopping follow the Saharanpur pattern referred to in *para.* 12. Certain species are completely protected everywhere, other only in specified localities while some are open to lopping without restriction. Unfortunately these restrictions in the post-1939 period have been difficult if not impossible to enforce in actual practice. The rest period has hitherto not drawn the attention it deserves in the hills. To ensure the enforcement of irksome restrictions, it seems desirable to take the villager into confidence by introducing panchayat* control over lopping.

20. Along the foot hills, in the well-wooded sub-montane tract, fodder supply is plentiful. The *tarai* yields excellent grazing practically all the year round. During the summer, when a good burn induces fresh growth of grass, vast herds of cattle migrate into the *tarai* from the adjoining districts. Leaf-fodder replaces grass which turns inedible with advancing winter and supports vast herds of *Gujars'* buffaloes throughout the *bhabar* tract.

A village council.

The estimated coefficients of available food supply per cow-unit for this region (Dehra Dun and Naini Tal *Tarai* and *Bhabar* tracts) are as under :—

	Acres.
Grazing grounds	2½
Agricultural by-products ..	1/3
Fodder crops	1/50

But for the need of extension of the cultivation of fodder crops, and the necessity for stricter control over lopping, the general fodder situation in this region is satisfactory.

(ii) The Gangetic Basin.

21. The Gangetic alluvium, where 70 per cent, of land is under cultivation, has to find food for about 38, million cow-units. The task has been rendered exceedingly difficult due to war conditions which are responsible for food shortage and consequent rise in prices of agricultural produce resulting in a continuous encroachment of the plough into pasture lands. In the western and central part of this region, *usar* (saline) and *bhur* (sandy) soils provide a measure of relief to the forlorn cattle. In the sterility of *usar* soils lies Nature's only safeguard against the all devouring cultivation. The refractory behaviour of these soils and their tardy response to the reclamation schemes for agricultural purposes, point unmistakably to the object they should serve, namely, the provision of grazing grounds.

22. The limited fodder supply due to the scarcity of grazing grounds affects the efficiency of cattle. This deficiency is sought to be made up by an increase in their number. With more months to feed a vicious circle is formed out of which there is no escape. While pasture lands, where available, yield fairly good grazing for the four monsoon months and part of the winter season, they provide little else except exercise thereafter. For the remaining six months in the year, livestock must increasingly depend on by-products of agriculture, leaf-fodder and fodder crops. The emphasis on stall-feeding would appear pointless if it remembered that except during the rainy season and part of the winter, milch and plough cattle are usually stall-fed for the rest of the year.

23. The direction in which improvement of fodder supply is to be looked for lies towards the extension of area under leaf-fodder trees and fodder crops. Unfit for anything else, *usar* lands, amounting to a little under 2 million acres, provide an opportunity for the creation of fodder reserves. Simple periodic closure during the rainy season, accompanied by the planting of leaf-fodder species in all pockets of good soil, free from calcareous deposits, is all that is needed for converting these desolate wastes into fair pasture lands. *Bhur* (sandy) lands which are confined largely to the Rohilkhand division, the Ganges (Kholas) high banks and the Jumna ravines provide similar opportunities for raising leaf-fodder species and improvement of grazing in general.

24. During comparatively recent years, the creation of fuel-fodder reserves in rural areas has specially engaged the attention of the Government of these Provinces. On March, 31, 1946, the Land Management Circle had 795 plantations covering an area of 6,185 acres. Small as these plantations are, their value lies in the demonstration they provide of the possibilities of afforesting vast unculturable lands lying unproductive in these provinces. The introduction of leaf-fodder species in these plantations will go a long way to supplement fodder supplies during winter.

25. The estimated coefficients of available food supply per cow-unit in this region are given below:—

	Acre.
Grazing grounds	1/3
Agricultural by-products ..	4/5
Fodder crops	1/25

(iii) The Central India Plateau.

26. The trans-Jumna tract is typical pastoral country supporting vast herds of cattle. The sandy loams (*parua*) along gently undulating well-drained plains, yield excellent fodder grasses. The *runds* in Jhansi and similar tracts in Hamirpur and Jalaun districts breed excellent cattle, goats and sheep. Grazing grounds are covered with tree-growth, and leaf-fodder is easy to come by. The estimated coefficients of available food supply per cow-unit are as under:—

	Acre
Grazing grounds	1/3
Agricultural by-products ..	1
Fodder crops	0·0036

There is both room and need for the extension of area under fodder crops in this region. Leaf-fodder plantations on grazing lands will considerably ease the situation during the cold weather when grasses turn inedible.

APPENDIX IV (3)

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It is now well recognised that the fodder supply in India from all organised sources falls far short of the livestock requirement. Besides the quantitative insufficiency the food of animals in India lacks in quality as straw which is nutritionally poorer in many respects as compared with green fodders constitutes about 50% of the total roughage supply. Except in big farms the village animal subsist on wheat and other cereal straws from April onward and the stock of the farmer usually finishes before monsoon sets in. During the four monsoon months fodder is plentiful under normal conditions when the sun-scorched grazing grounds turn into green pasture lands. It is only after the end of rains that fodder situation Compels attention and substitutes are looked for, when both men and cattle wander far and wide in search of fodder. The period which constitutes the weakest link in the chain of fodder supply is, therefore, November to April. Almost the entire lopping of forests and road side avenues takes place during this period.

It has not been possible to collect accurate information about the extent to which the tree leaves are used in different provinces to supplement the supply of fodder but in the United Provinces where accurate information has been collected by the Forest Department only 12 per cent. of the total livestock is dependent for supplementing its feed on leaf fodder for about 5 months in the year (November to April). With the advent of spring most of the leaf fodder trees bear new foliage which being toxic in certain cases are considered unsuitable as cattle feed.

It is interesting that inspite of the long usage of tree leaves little work has been done on the chemical composition and the nutritive value of these leafy fodders. The Animal Nutrition Laboratories of the Indian Veterinary Research Institute at Izatnagar in collaboration with the United Provinces Forest Department have undertaken a systematic investigation to find out the nutrients of the commonly

fed tree leaves. The work is still in progress but some of the observations made so far at Izatnagar and Lyallpur indicate that practically in all species of tree leaves irrespective of the date of lopping the crude protein content may be considered high when the figures are compared with those of the usual cultivated fodders of non-leguminous variety. In some cases the protein value is comparable to that of leguminous fodders such as berseen and lucerne. Perhaps the most unique feature in tree leaves is their excessive richness in lime. In majority of cases the lime content is easily twice as much as that of calcium rich cultivated fodders. The excessive lime content has conferred unusual lime phosphate ratio as 5 : 1 to even 16 : 1. Although the lime phosphate ratio is very wide in tree leaves in majority of the samples the phosphate content may be considered optimum when compared with the commonly used green fodders. The other extract in tree leaves is rather high ; a fair proportion of this constituent however is made up of pigments of questionable nutritive value ; the crude fibre in leafy fodders is found generally low. Magnesia like lime is also found in relatively larger amount.

The digestibility coefficients and the nutritive values of only a few tree leaves have so far been studied with a limited number of animals. According to this limited information available at present the apparent richness of nutrients in tree leaves as shown by their chemical composition gives an erroneous idea of the nutritive value. The extremely low digestibility of crude fibre and somewhat less so of crude protein and nitrogen free extract are particular features in the feeding of tree leaves. Inspite of almost equal amount of crude protein in green oats Bajra and bersi leaves the digestibility co-efficient of beri leaves is only about 50 per cent of oats or bajra.

In view of the low digestibility co-efficient of the important nutrients leafy fodders are inferior to commonly cultivated fodders of similar chemical composition. Leafy fodders however seem to compare in energy value to poor types of dry roughage though they contain a fair amount of digestible crude protein. Investigations on the causes of lower digestibility coefficients and the estimation of nutritive value on a larger number of animals are in progress. There are also indications of liver and kidney damage when cattle are fed on leaves. It is therefore suggested that before any country wide operations are undertaken it will be advisable to wait for these results. Meanwhile half a dozen large scale experimental feeding centres may be started in different areas to assess the nutritive value of the locally available leaves on different species of animals.

APPENDIX-IV (3)

(*d*) By Dr. R. Maclagan Gorrie, D.Sc.

In the following notes I shall confine myself to the drier parts of the Punjab, taking the dry zone to apply to a rainfall of 18"-45" and the arid zone having less than 18".

A comprehensive survey of fodder trees and shrubs for India and Ceylon forms a section of a forthcoming publication entitled "Use and Misuse of Shrubs" which is being issued as Technical Communication No. by the Imperial Forestry Institute, Oxford. This will be the most comprehensive and thorough analysis yet made of our leaf fodder resources and should therefore be in the hands of all those interested in the improvement of livestock in India. In view of this publication the following remarks will be confined strictly to a summary of the position as regards areas deficient in rainfall.

There are two distinct methods of using lopped fodder. One is as a famine or shortage relief measure, and this is generally so drastic as to harm the tree seriously or

even cause its death if persisted in. This form of use, or rather misuse, is usually a desperate attempt to keep straying animals alive, or is alternatively the utterly destructive work of intinerant graziers. In either case the question of whether the tree remains alive or not is a secondary consideration and inevitably leads to complete disforestation.

The other and more logical and intelligent use of tree fodder is in those few districts where it is used on a restricted and seasonal basis and on a rotation which allow the tree a full chance of recovery. Examples are seen the oak lopping in the Kulu valley and in the use of *Morina pterygosperma* as a hedgerow tree in Ambala and the adjoining districts. Another example is the use of *jand* (*Proposopis spicigera*), as a hedgerow tree in Dera Ghazi Khan and other arid districs. In Dera Ghazi Khan it is noticeable that a good cultivator who has his field bunds properly maintained also has a regular succession of age classes of *jand* natural seedlings in and around his fields, these trees being lopped on a very conservative basis which allows each one to develop a restricted but healthy and fully productive crown. Conversely a bad cultivator whose bunds are breached and neglected usually has only a few dying and overlopped *jand* with no attempt at conservation of a succession of natural seedling.

In areas of slightly better rainfall *kikar* (*Acacia arabica*) is frequently treated in the same way but in most places the exploitation of *kikar* lopping is so improvident in the dry southern districts that both the Irrigation Branch and the Forest Department have given up hope of maintaining *kikar* avenues and roadside plantations in face of the universal misuse of this most valuable tree. The *kikar's* best contribution to fodder is the young pods before they ripen in April but winter lopping of twigs effectually prevents any flowers from setting seed.

I have been criticised in the past for stating that the peasantry of the western Punjab is associated, in my own mind with the complete destruction of tree growth, but so far as one can ascertain this charge is historically correct. Scantly but reliable records show that the whole of the Western Punjab uplands and plains were at one time fairly fully covered by forest growth and that this continued all through the Buddhist occupation of Taxila, in fact serious disforestation is only recorded within the last few centuries and accelerated by the *Pax Britanniae*. In the case of Montgomery district many of the original irrigation grants were given on a condition that hedgerow timber should be produced, but the general tendency in both irrigated and unirrigated tracts south and west of a line adjoining Delhi, Lahore and Rawalpindi shows the progressive destruction of all tree growth whether natural or previously planted.

In view of this situation one can therefore hold out no hope for tree fodder as a solution for the fodder problem in our dry and arid tracts unless and until the number of animals has been reduced to what can be maintained on the available grass, straw and cultivated fodder crops. Once such a balance has been set, then we may be able to make some worthwhile contribution with tree fodders by intensive planting of tree species in the hedgerows, field edges and waste lands. But so long as all trees, including our long-suffering roadside and canal-side avenues, are being massacred to save hungary herds from starvation I can see no future for fodder tree planting in the arid zone, and the utmost we can attempt is the afforestation of waste land and roadsides with the less palatable species which we have some hope of preserving. On the other hand, given a modicum of protection there are a considerable number of tree species which will not only flourish but will yield a reasonably good quantity of high grade fodder if lopping is carefully controlled and carried out only at a suitable season and on a strictly observed rotation.

Amongst individual species there are some striking examples of variation in their fodder value under different climatic conditions. As examples let me quote :—

(*i*) *Butea fronosa*, dhak or " flame of the forest ", is hardly lopped at all in the northern parts of the C. P. where it is a major species in mixed forest, whereas in the pure stands of *Butea* along the base of the Siwaliks in Saharanpur, Ambala and Hoshiarpur it is very heavily lopped on a rough rotation which aims at keeping the trees alive as long as possible. This *Butea* leaf fodder is regularly stored as dry bundles in the roofs of houses and in the forks of trees for use as an emergency fodder during the subsequent cold weather. When not required for this purpose the dry leaves are used as litter and eventually find their way to the fields as manure.

(*ii*) *Melia Azedarach*, " the Persian lilac ", unlike the first example, appears to have a higher palatability in the wet zone than in the dry one where it is seldom lopped for fodder although it is a great favourite as a shade tree within the compound walls of village houses throughout the western Punjab.

(*iii*) The pods of *Acacia leucophloea* are a favourite cattle fodder in parts of Madras, but although the tree is very common all through the Punjab dry rakhs I have never seen the pods used in this way.

(*iv*) Although a grass and not a tree, *Saccharum spontaneum* the dreaded *Kans* grass of northern C. P. is reckoned as being quite useless for grazing or fodder there, whereas in our Punjab torrent bed reclamation it is the first natural pioneer wherever sandy tracts are closed to grazing and is regularly cut for fodder all through the hot weather and the monsoon.

New sources of bush fodder are also becoming available in many of our dry and arid zone closures which are usually legalised by the application of section 38 of Indian Forest Act on the voluntary application of a majority of the owners. The effect of such closures is to revive the common bushes which owing to persistent grazing have been practically eradicated. An outstanding example is *Indigofera paucifolia* in the Attock rakhs. It has not yet been established how far this can be used as a fodder but as practically all the *Indigoferas* can be used in this way it is worth making a determined effort to effect a very gradual introduction of this species as a lopped fodder ration.

The lists of species frequently published in the past by forest officers, starting with J. F. Duthie's " List of fodder trees " of 1889 and E. M. Coventry's Punjab list of 1900 and finishing with M. V. Laurie's *Indian Forest Leaflet No. 82* of 1945 do not always differentiate between fodders normally used by one or other of the domestic animals. Thus very long lists of species have been complied which give a somewhat erroneous impression of the choice of species available, particularly in the dry and arid zones. Again, many of the palatable species which are common in the eastern Punjab do not persist in the west so that the number of species is again reduced by the species' own ecological limitations. I have therefore not attempted to give a detailed list for the province as such a list, unless divided into a considerable number of regions, would give an entirely misleading impression. The main species on which we must rely for our desert fringe shelter-belt work in the southern districts are :—

(*i*) *Acacia arabica* (*kikar*) subject to the limitations stated above of its very easy extermination.

(*ii*) *Prosopis spicigera* (*jand*) whose very slow growth renders it even more vulnerable to misuse.

(*iii*) *Prosopis juliflora, the Mesquite*, whose leaves are unpalatable but whose pods produced twice a year are a useful fodder.

(*iv*) *Albizzia Lebbek* and *procera*, the *siris*, is reckoned in some of our western nd southern districts to be an outstandingly good cattle fodder, so much so that its future as a roadside tree is like the *kikar* seriously jeopardized.

In view of the enormous quantities of *Dalbergia sissoo*, the Punjab *tali* or shisham now being planted each year in our afforestation work throughout the uplands of the province a special note on its use as fodder may be justified. Normally the sissoo i- not lopped for fodder in the Punjab though it is listed for many other province including Baluchistan as being a fodder species. It is only in times of extrem scarcity that the sissoo is here lopped for fodder as the fresh leaves are said to produc diarrhoea and other digestive troubles. Experiments carried out by Lander an Dharmani at Lyallpur have shown that a good silage can be made from the stippe leaves of sissoo, but the practical application of this experimental result has not so far proved successful. Our own attempts at making pit silage with leaves freshly stripped from sissoo branches have not been successful, partly owing to the great labour involved in stripping the leaves from the cut branches, and partly owing to the very high percentage of wastage through the outer part of the silced material going bad.

Speaking of silage generally it is significant that now here has silage either of grass or leaves been established on a practical basis as a routine meaure by the zamin dars themselves, except in the one instance known to me of Jullundur where the persistent efforts of the late Maulvi Fateh-ud-Din did succeed in popularising this type of storage. Owing to the amount of labour involved and the risk of heavy wastage from unsuccessful or only partially successful pits it appears that silage will not be established as a routine argricultural measure until a great deal more of *practical demonstration* rather than of verbal or leaflet propaganda has been, done. This is particularly so in the dry and arid tracts where the present surplus of cattle and failure to conserve any grass for cutting render silage proposals quite impracticable until a better regime of soil and water conservation provides a better seasonal flush of grass and leaves for siling.

Having first established a better regime of fewer animals and a better seasonal production of grass and leaves with which to build up a reserve of dry fodder or silage the question of the correct rotation for lopping of fodder trees has still got to be determined. All we know so far as regards the Punjab dry and arid districts is that previous practice has almost entirely eliminated tree growth. We know from this is that lopping has been so destructive that tree growth cannot survive in face of this misuse. It is probable that once we can establish and protect plantations and avenues of fodder species we may require to enforce a considerably longer rotation than is adequate for, the same species in the zones of higher rainfall. The proper rotation for *kikar*, *jand* *mesquite* and *siris* will each have to be worked out on a basis of trial and error but it is unlikely that any of these will stand up to annual lopping and it can be presumed that a 3 year rotation in the dry zone and a 4 year rotation in the arid zone will probably give us the highest yield of palatable fodder.

As regards the relative palatability of tree fodder, here again we have little or no actual data for the arid zone, or in fact for any of our Indian conditions. In an article on the role of leaf fodder in animal husbandry in the U. P. printed in an *Indian Forester* of 1945 M. D. Chaturvedi observes that as the cold weather advances so the hay from fodder grasses decreases in its palatability so it is in the early spring that leaf fodder is of most value. He observes that tree species of *Adina* *Bauhimia* and *Morus* are rich in crude protein, crude fats, lime and nitrogen-free extractives. There is an obvious lack of data on the relative digestibility of the various leaf and pod fodders. As noted above the pods of certain *Acacias* are not fully utilized and it may be that a very simple treatment would render them palatable. Data showing

a very high nutritive value for the pods of *Prosopis juliflora* were worked out at Lyallpur by Lander and Dharmani and were recently republished in *Punjab Forestry Notes No.* of 1943, but their use in practice is restricted to the very short period of ripening because once the pod hardens it is no longer very palatable.

European experience of leaf fodders is summarised in a recent *Growmore Bulletin No. 8* of the Ministry of Agriculture and Fisheries, London. This states that as a result of war shortages of ordinary fodders tree leaves have been much more commonly used as fodder than in the past, particularly in France, where the elm is preferred. The main drawbacks to leaf fodder use are labour shortage and the time required for the collection of the leaves, and as we have already pointed out this also applies to our own attempts with sissoo. This bulletin states that the following species under European conditions have 2/3rds of the food value of hay when used fresh :—

elm.
ash.
beech.
acacia.
poplar.
willow.
lime.
hornbeam.
chestnut.

The dry leaves are said to have a higher value than the average hay, but it is not clear from this whether tree leaves improve in feeding value as a result of drying.

As a further result of wartime shortages the same bulletin indicates that many tree fruits such as mountain ash berries, horsechestnuts and oak acorns can be prepared as a mash by grinding, washing and adding salt. Such preparations are more useful for feeding poultry and pigs than cattle but this experience indicates that our own local resources of tree fruits have not been fully exploited as a possible source of fodder. Another notable development which we might follow up is the growing of sunflower for its seed crop as a food for domestic animals. This can readily be cultivated in waste land hedgerows the banks between terraced fields and amongst young trees in afforestation areas.

The use of caustic soda as a means of rendering course straw into a more easily digested material is now an accepted method of improving forage residues. After boiling with caustic soda the soda has to be washed out of the boiled straw before this is fed to the livestock, but the same soda solution can be used over and over again. Given a plentiful supply of wood fuel, which will admittedly be the limit in factor in most places, this method of predigesting coarse vegetable matter such as the stalks of *Jaint* (*Sesbania*) and the leaves of *Agave* should be worth investigation and thorough trial.

To summarize, the production of tree fodder in the dry and arid zones will only be justified if this work forms and integral part of a wider programme, the more important items of which must be :—

(*a*) a sound soil and water conservation policy, which will in itself greatly increase the production of herbage and jungle fodders from fallow and uncultivated land.

(*b*) the conservation and improvement of natural pastures and grasslands, and the closure either permanent or rotational of existing common grazing land.

(*c*) a drastic reduction in surplus cattle and the rigid control of itinerant graziers and shepherds.

(*d*) a concentrated effort in the practical demonstration of ensilage and storage of fodders.

APPENDIX IV (3)

(e) (5) By E. E. A. Garland.

In the traditional usage of the Province it has been customary to divide Sind into three parts ; northern, central and southern. These were " Siro ", or Upper Sind ; " Vicholo " from about half way between Larkana and Sehwan to Hyderabad; " Lar " from Hyderabad to the sea. For ecological purposes a longitudinal, instead of latitudinal, classification is more convenient, though here again the division will be into three main parts. Along the western border of the Province is a hilly region known to geographers as the Khirtar Range and locally as Kohistan, rising to over 6,800 feet at the highest point near its northern end and gradually decreasing in elevation to 500 feet just north of Karachi. In the centre is the Indus valley where conditions are in the main dominated by the great river Indus, as modified by the Sukkur Barrage and other irrigation works of varying magnitude. On the east is a typical desert upland region (Thar Parkar) ; though a long its southern extremity and extending across the Indus river delta there is a region of tidal swamps which probably deserves to be considered as a fourth and separate class from the three main divisions.

2. It is a peculiarity of the Province, as a whole, that though rainfall is everywhere normally extremely deficient, averaging from 5 to 10 inches annually, the eastern desert seems to receive more than either of the other two classes, owing presumably to it alone coming within the extreme outer borders of the S. W. monsoon which is the dominating climatic factor along the rest of western coast of the Indian peninsula. In the Indus valley, thanks to man's ingenuity rainfall has become of steadily decreasing importance, crops being raised by irrigation over increasing areas and the desert area dwindling in size accordingly. Unfortunately, as has been the case in most parts of the world, the two sections of the Province which are ecologically most primitive, the so-called " barren " hills on the west and the desert on the east, have in the past received hardly any scientific attention, in spite of the fact that conservation of the scanty flora and careful management of the very limited natural resources of such poor regions are arguably as important functions of humanity as is the similar treatment admitted as due to the poor and destitute among men. Official records all seem to agree in stating that the best livestock have in the past come from the hill region and from the desert, though whether this would have been possible without the advantages of seasonal migration to the Indus valley may reasonably be doubted. In any case Sindhi livestock of all sorts have achieved a reputation for excellence, beyond the borders of the Province, such that their export has been on a considerable scale in the past in order to meet a regular demand. Such an asset therefore should not be lost merely by neglect to protect or strengthen the foundations on which it has been built, nor by failure to adapt the structure so as to coincide with other changes which must powerfully affect it. In Sind before man began to interfere extensively by irrigation and engineering works, the annual floods from the Indus spread far and wide over the valley consequent upon the melting of the snows in the high-hills of the Himalyas where the river and its tributaries have their sources. Population was scanty and grazing abundant after the floods subsided. Gradually these flood waters have been brought under control by an elaborate system of embankments and canals so that the rising waters can be kept from flooding to excess many of the low lying lands and can also be directed further afield along canals so that crops can be grown over extensive areas with reasonable security. Only a fairly narrow margin on both banks is left between the two main lines of protective embankments, within which the flood waters are retained. Thus a primitive, pastoral, society has steadily been converted into settled agriculturists and this process is continuing at a rapidly accelerating pace since the construction of the Sukkur Barrage, which within

the large area under its command has effectively created what amounts to a new climate by the provision of perennial water in its canals, whereas the previous canal systems only expanded, regulated and some what prolonged, the distribution of water during the flood season, which happens to correspond roughly with the monsoon season in other parts of western India. It is a universal experience that simple pastoral peoples will only abandon their traditional ways of life with the greatest reluctance and that their obstinacy is such that they almost invariably involve their windling grazing grounds in practically total and permanent destruction, by endeavouring to continue to pasture excessive number of animals, before they surrender. In Sind, even assuming that some part of the desert uplands could eventually be canalised and brought under irrigated agriculture, which is extremely doubtful, most of the region will always be too high for irrigation, as is still today the case many parts of the Indus valley, capable only of producing a scanty vegetation consisting largely of shrubs and stunted trees of which the most typical are Prosopis spicigira, Zizyphus, nummularis, Acacia Senegal, Commiphora mukul Salvadora persica and oleoides, Calligonum polygonoides, Capparis aphylla and Calotropis procera, all of which are in varying degree useful for fodder. In addition there is the coastal fringe of swamps where mangrove species, if properly managed, may be a valuable source of permanent fodder.

3. How Sind will deal with problems thus presented still remains to be seen. The assumption is made above that a co-ordination between pasturage in the hills and desert combined with migration to the valley lands along the Indus is a basic factor. This is on account of experience in the riverian areas of the Indus vally where almost all the lands allocated for management to the Forest Department are situated. Most of these lands were apparently originally set apart as hunting grounds by the Mirs, who preceded the British in ruling Sind. A few may also have been poor lands which by general agreement it was found convenient to keep as grazing grounds and sumps for draining off surplus irrigation water from neighbouring fields under clutivation. These usually surround one of shallow depressions, known as "dhands" some times of large extent and holding more or less perennial water which are such a characteristic feature of Sind and are perhaps remains of earlier beds of the vagrant river Indus. Although the lands under the Forest Department management are almost all in the riverian tract of the Indus valley, their ecological status is forcibly varied by whether they are inside or outside the protective embankments and are accordingly watered either by the unrestrained annual inundations of the Indus, or, if inside the protective embankments, have to rely principally on getting canalised irrigation water. For the former the acreages receiving water and the depth as well as duration of watering of course vary from year to year. Even in the best years however there are always some high-lying sand dunes and elevated stretches of land which are above high water level. The actual levels of the lands also are perpetually changing as silt is deposited or washed away and large scale complete erosions by the river, as well as new depositions elsewhere in the form of low, mud flats or sandbanks, which may either be raised to higher levels or again washed away in subsequent years, are constantly taking place. All these parts of the forest estate are therefore subject to constant change and the practice of forestry under such conditions necessitates a technique very different from standard methods employed elsewhere. Tree crops however have a great advantage over ordinary agricultural crops in such areas that once established they can stand considerable amounts of flooding, if their heads are above water; or alternatively can continue to exist through one or more years when water does not rise sufficiently to flood the land, provided that they have got their roots down to moisture soil below ground level. In the northern end of the Province, the principal tree grown is Prosopis

spicigera (kandi) with Populus euphratica (*bahan*) important in some places. In the southern half there is the marked difference that Acacia arabica (*babul*) forms about 80 per cent. pure crops, this change in species being due to frosts in the northern half of the Province, which *babul* will not tolerate so well as *kandi*; Both these species however are of value for fodder purposes as well as for the production of fuel for which they are principally grown. *Babul* is specially valued for its fodder and the pod season, which opens about April is eagerly awaited. *Kandi* pods, which are also utilised for fodder, form later than those of *babul*, thus supplementing the fodder supply and extending it all through the hot season until the floods start. The leaves of babul are valued to improve milk and nutrition during the cold months of the year, but their removal has to be severely restricted in order to prevent damage to flowers, ruin of the pod crop and consequent lack of seed, which is required in very large quantities. for the annual sowing operations in the riverian areas which are either being newly formed by sufficient depositions of silt, or where, in lands further away from the river, the height of inundation has been paticularly suitably for regeneration. Out of some 1,120 square miles under management by the Forest Department approximately 1,000 square miles are usually open to grazing. As well as the fodder from the pods and leaves. there are in many places excellent natural grass crops, which spring up vigorously after the floods subside. Of the above 1,000 square miles about three hundred are usually available for all animals, including sheep and goats while from the remaining 700 square miles sheep and goats as well as camels. have to be excluded owing to the damage done by browsing on the tender shoots of young tree crops which have not yet grown above the reach of these voracious animals. It is however a special feature of forestry in Sind. which has been developed only in recent years, that the co-operation of the herdsmen of flocks of sheep and goats is obtained and utilised under careful supervision to carry out the cleanings and spacings required in dense crops of young babul, whereby the herdmen obtain the loppings from the young trees cut out by them in these cleaning and thinning operatoins, thus getting an abundant, supply of green fodder for their animals and at the same time assist the silvicultural well-being of the crops by proper spacing of the young trees. The superior germination, obtained from *babul* seed, which has passed through goats is also a well known way, in which these, animals. which in many parts of the world have been responsible directly for so much erosion by destruction of sparse vegetation on hill sides, are useful, under control. In recent years there has been a steady increase in the numbers of all animals brought into the forests for grazing. This way be partly due to unusually good crops of grass and other fodder being available on account of a series of unusually high inundations. It is however also most probably due to steady decrease in other areas available for grazing in the Indus valley as more and more lands are being brought under permanent agriculture with better prices for crops and increasing canalisation and wider facilities for irrigation Decrease in available fodder in the hills may also have been a contributing cause but as already stated little or nothing is known of the changes occuring in that regions. The numbers for which the Forest Department has received fees are :—

	1943–44	1942–43	Average 40–41 42–43
Horned cattle	95,569	70,596	65,142
Goats and Sheep	181,558	167,016	134,625
Camels	2,486	1,660	1,942
Others	2,210	1,470	2,016
Total ..	281,853	240,712	203,625

4. The above admissions include those to the "inland" parts of the Forest estate, that is to say lands cut off by the protective embankments along the rive and so receiving water only by special sluices in the embankments or from the Public Works Department canals. For many years most of these "inland" forests have been some of the poorest parts of the estate, much of them being very dry or else "*kalar*" land so impregnated with salts as to prohibit almost all vegetation, except perhaps scattered bushes of Salvadora persica (*khabar*), or on better but dry areas rather stunted Prosopia spicigera (*kandi*), with Tamarix spp (*Lai*) in depressions where water was apt to stagnate. More recently as the Sukkur Barrage and other irrigation works have made more water available and brought it to areas theretofore beyond the reach of irrigation, the Forest Department has evolved a technique for developing these lands which holds out great promise of being highly successful. The method employed is to provide for irrigation from the Public Works Department canals in much the same way as is done for ordinary agricultural lands and then to raise trees from seed, sown in lines, usually with intervals of 33' or 40' between the lines, the intervening lands between the lines of tree seedlings being leased out for cotton or grain crops for several years until the young saplings in the lines become too big to permit profitable arable cultivation beneath their shade. Thereafter the whole area between the lines of trees is put down to grass until the former are ripe for exploitation as fuel at from 15 to 25 years old according to locality. Then they are felled and the whole process is repeated. This system not only promises to increase greatly the production of fuel on such areas, but has also proved financially profitable. Thus, what were formerly chiefly useful as grazing grounds for camels, are steadily being transformed into intensively managed estates. As *babul* has already proved suitable for such plantations, about 2/3 to 3/4 of such areas in which *babul* is planted will be most valuable grazing grounds, where a combination of grass and tree fodder will be available. Experiments with other tree species are also in progress. Much still remains to be done and extensive scientific research is urgently needed to work out the best combinations and rotations in this system of alternating husbandry, which is in its own way a development of the principles underlying the increasing use of temporary grass leys in England. There seems no reason to doubt that, where a demand for high class grazing for high grade cattle and for milk production can be developed and lucerne or similar expensive fodder crops can be substituted for self sown grasses, after 4 or 5 seasons under arable crops, the productive capacity of such areas could be increaed sufficiently to solve many of the problems now facing Sind. Increasing demands for milk and cattle coinciding with the spread of irrigated agriculture and a consequent decrease of common grazing grounds, combined with lack of planned production of fuel, and fodder crops must inevitably result in serious dislocation of the rural economy of the Province. By careful distribution of estates managed on these lines, throughout all the Province on an adequate scale, local demands for fuel and fodder could be met and properly co-ordinated with the export of fuel, milk and corn surpluses to urban centres. Such estates could also become valuable centres for schemes of co-opertive marketing and for demonstration of new ideas, in the mechanisation of agriculture, power irrigaton and similar developments for which a shortage of man power renders Sind an almost ideal location. As forest plantations alone, or as pastures alone, it is unlikely that they could be managed at a profit at present. Handed over for ordinary agricultural development these lands, like all others, would be almost certainly turned to maximum cash production under arable crops. By combining fuel and tree fodder prodution with pasturage and rotating these with arable crops, several useful and indeed valu able purposes can be economically combined.

5. While therefore the place of fodder from trees and shrubs in this Province may not appeear superficially to be of great importance, it provides a necessary link in a

chain of land utilisation methods. In the dry hills and in the deserts, on the flanks of Indus valley, fodder from shrubs probably represents at least 50 per cent. of the productive capacity of these two zones. In the Indus valley, where irrigation costs necessitate a high standard of utilisation of productive capacity, the use of tree fodder in combination with fuel production is of considerable importance. The possibilities of shrub fodder production under trees also appears to merit thorough research, in conjunction with parallel research in shrub fodder production in dry zones. The proper management of mangrove growing on tidal swamps along the coast is a kindred subject for research, about which nothing has so far been done in this Province. It is possible that experience in lands where climatic conditions are more favourable to grass crops may in the past, have under-rated the value of shrub fodder. Now that even dead timber has been proved capable of conversion by suitable treatment into palatable fodder, the nutritional value of leaf fodder from trees and shrubs deserves thorough re-examination in the light of new knowledge of digestive processes.

BRIEF DESCRIPTION OF SOME FODDER TREES AND SHRUBS IN THE PROVINCE OF SIND.

Scientific name.	Sindhi name.	Description.
Acacia arabica	Babul	Recognised throughout the Province as the best fodder tree, flowers, leaves and pods are a favourite fodder for all cattle. In years of plentiful pod crop some of the pods and seeds are stored to be used as fodder at a latter date. When their use is so postponed they are usually boiled before being given to cattle.
Prosopis spicigera	Kandi	Flowers, leaves and pods excellent fodder for all cattle. Pods contain a pleasantly flavoured farinaceous pulp which is consumed as *food, by the poorer classes in times of* scarcity in the desert areas.
P. glandulosa	Persa Persi	Pods are eaten by the goats and cattle.
Populus euphratica	Bahan	Flower buds are good fodder for all cattle.
Tamarix spp	Lai	Leaves are eaten by camels.
Zizyphus nummularis	Ber	Leaves good for all cattle.
Dalbergia sissoo	Tali	Leaves medium class fodder.
Albizza lebbek	Sirah	Leaves medium class fodder for all cattle.
Azadirachta indica	Nim	Do.
Acacia senegal	Khor or Khumbhat	A good fodder tree in dry tracts.
Commiphora mukul	Gugul	Do.
Salvadora persica	Khabar	A medium class fodder—much relished by camels.
Salvadora oleoides	Peeloon	Do.
Calligonum polygonoides	Phog	A *medium class* fodder for all cattle in dry district.
Alhagi camtanulorum	*Kanderour*	A *good camel* fodder.
Phyllanthus reticulatus	Kamo	A good fodder for goats.
Calotropis procera	Akk	Do.
Salsaola foetide	Luni	Good camel fodder.

APPENDIX IV (3)

(f) By Sardar Bahadur S. Harchand Singh, L. Ag., Commissioner for Agriculture, Patiala.

Patalia State forms that part of the Punjab where in the extreme northern part of the State, the climate is cold while in the southern part of the State, it is completely dry and arid. Thus all extremes of temperature are met with in this area. Vast areas of land are canal irrigated, well-irrigated but still there are large tracts of the State which are climatically dry and consist of arid regions, such as Bhatinda, Narwana and Narnaul. It is particularly in these arid regions that the scarcity of fodder for cattle is generally felt, while in those parts of the State which receive sufficient rainfall or have been traversed by canal or well water, there is no trouble of fodder. It is particularly in these arid regions of the State that the use of leaves and soft twigs as fodder for cattle has been in vogue.

It may be a matter of coincidence in nature, observable in these districts particularly Narnaul that the cattle fed on leaves and such green shoots when available are generally stout and strong in physique and quite healthy to look at. Such parts of the State have been inflicted with fodder famines frequently on account of failure of seasonal rains and the cattle of this area have learnt to make use of available leaves and also have thrived upon it. The famous breed of cattle which has established itself within this dry and arid region, is known by the name of "Hariana breed". Dharson and Karhota Cattle Fairs of Narnaul attarct large number of cattle breeders from within and outside the State. The total number of transactions of animals at these cattle fairs during the year 2002 (1945-46) was 22,277.

The fodder trees and shrubs which are playing an important part to meet the feeding requirements of the cattle of the dry areas are as under :—

1. Zizyphus Nummulava ; (Jhari Beri shrub)
2. Acacia Arabica, (Kikar)
3. Ficus Religiosa, (Pipal)
4. Cappris Horrida (Hins)
5. Calotropis Gigantea (Ak)
6. Dalbergia Sissoo; (Shisham)
7. Azadirachta Indica (Nim)
8. Jand.

1. Zizyphus Nummulava, (Jhari) Beri shrub.

This shrub is used both green and dry. The leaves of this shrub are stored when in excess in the rainy season and fed during winter. It grows wild during rains and with little moisture makes vigourous growth. People cut the young twigs and leave them to dry in the fields for a day or so. On the next day the twigs are beaten with a stick and when all leaves are separated then these are stored. These leaves are known as Palla. It is one of the finest feed for the cattle in winter. It is fed as such or is mixed with other fodders.

2. *Acacia Arabica (Kikar.)*

This tree is generally found in dry tracts. It is mainly fed to the goats and camels. Its young branches are cut down from the trees and chaffed into fine fodder. This is usually fed green. In case of scarcity of fodder in the irrigated areas on account of fodder famine, this tree is used for all the cattle. Its fruit while green and fresh is given to the milch cattle.

3. *Ficus Religiosa, (Pipal).*

Its leaves while green are fed to goats and camels

4. *Cappris Horrida, (Hinds.)*

Its leaves are used for feeding goats and camels.

5. *Calatropis, Gigantea, (Ak.)*

It is used as fodder for grazing goats only.

6. *Dalbergia Sissoo, (Shisham).*

Its leaves are used as fodder for cows only.

7. *Azadirachta Indica (Nim).*

Its leaves are used as fodder for camels only.

8. *Jand.*

The leaves and furit of this tree are fed to cattle goats and camels.

The only method of increasing the supply fodder received from the fodder tree is that before the setting of the rains, the seeds of fodder trees may be obtained from the Forest Department and spread in the unculturable waste and Shamlat Deh of the villages in these areas. These trees require no plantation and are automatic growers. Once their seed is spread these go on multiplying and as such the whole area is covered by these trees within a short time. The work can be taken up by the village Panchayats. The expenditure can be met from the Rural uplift Budget. These trees should not be grown very far off from the villages in order that the villagers may get the maximum benefit out of them.

It is really a good plan and it will decrease the expenditure of the farmers who have now to import fodder from other places on high cost during famines and will enable them to meet the fodder requirement of their cattle within their own villages in such emergencies.

APPENDIX IV (4)

AMENDMENTS TO FORMS NOW USED FOR PROVINCIAL LIVESTOCK RETURNS.

A NOTE BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH.

It will be recalled that at its meeting held in Madras in 1936 the Animal Husbandry Wing considered a note on the standardisation of the tables appended to the annual reports of Civil Veterinary Department of Provinces and States. The standard table suggested in the note were accepted with minor modifications, and with the approval of the Central, Provincial and State Governments were introduced in 1938-39. Minor modifications were since found necessary by individual Provinces in the light of experience of actual use of the tables. These were accepted off and on and adpoted in such a manner as not to affect uniformity.

Recently the U. P. Government suggested the inclusion of the following tables in the Annual Report of their Animal Husbandry Department :—

(*i*). Number of farm bred and purchased breeding stock issued during the year.

(*ii*) D. Statement showing the numbers of approved bucks at stud.

E. Statement showing the numbers of approved rams at stud.

F. Statement showing numbers of approved boards at stud.

(*iii*) A. Abstract of particulars regarding annual livestock fairs held during the year.

B. Abstract of particulars regarding annual (as well as one-day) live stock shows held during the year.

(*iv*) Statement showing the breeding results at the Government Farms.

(*v*) Statement showing the number of Ghee-grading Stations opened and expenditure incurred.

(*vi*) Statement of Egg-grading Stations in the United Provinces.

(*vii*) Statement of birds reared at Government Central Poultry Farm, Lucknow.

(*viii*) Statement showing tanks requisitioned, cleaned and stocked.

These tables are obviously necessitated by the extended activities of the Department, and some of the items are a modification of the information already embodied in the standard table.

In order, however, to retain uniformity in regard to the material hitherto incorporated and in order that their comparability with previous years as well as with data from other Provinces may not be affected the U.P. Government are keeping the order of the standard tables intact and adding the new ones to them.

When including this item in the agenda it was thought that the revision of the tables recommended in 1936 should be considered, but as no amendments or proposals for addition have been received from Provinces other thanthe U.P. and as the expansion under the Post War Schemes is still going on in all Provinces the matter does not appear to be ripe for consideration at this meeting. Further, an important change in the method of presentation of breeding results in the annual reports of Cattle Breeding Farms has been accepted by all Provinces as a result of discussion at the Advisory Board. The change has not yet been introduced and it is not known how the new form will work in practice. A summary of this also should find a place in the Departmental Reports. It appears, therefore, desirable to defer consideration of the revision of main tables to the next meeting of the Wing, and it is suggested that as amendments and corrections are formulated they should be submitted to the I.C.A.R. for coordination and the drafting of amended uniform tables. Meanwhile any changes desired may be incorporated after the standard tables as the U. P. have done.

Apart from what Provinces may themselves have to suggest, the co-ordination work at the Centre requires information in regard to the number of farms in the Provinces and States, the areas of the farms, the acreage under cultivation, the strength of herds and flocks maintained, their productive capacity and the number of breeding males issued. This information is at present being collected by correspondence. It will facilitate the work of all concerned if the information is incorporated in the attached form in the Annual Reports of Animal Husbandry Departments. A specimen table is given for each species of Livestock. These tables also will be revised in the light of experience when the general revision is taken up.

TABLE .....(a)

tement showing the location and other particulars of Livestock Farms in the Province/ te.....during.....

(a) Cattle and Buffaloes.

me and address of farms.	Area of the Farm.		Purpose of the Farm & Herd. (Breeding, Experimental or Dairy, etc.)	Breeds.	Strength of the herd in each Breed.		
	Total.	Under cultivation			Bulls.	Cows.	Young stock.
1	2	3	4	5	6	7	8

Number of series issued during :—			Average.			Remarks.
Year under report	Last year	Year before last.	Milk yield of the herd per lactation.	Days in milk.	Days dry	
9	10	11	12	13	14	15

TABLE.....(*b*)

Statement showing the location and other particulars of Livestock Farms in the Province/State.....during.....

(*b*) Sheep.

Name and address of farm.	Area of the Farm.		Purpose of the farm and flock.	Breed.	Strength of the flock in each Breed.		
	Total.	Under cultivation.			Number Rams.	Ewes.	Lambs.
1	2	3	4	5	6	7	8

Number of Rams issued during :—			Average wool yield per year.			Remarks.
Year under report.	Last year	Year before last.	Rams.	Ewes.	Lambs.	
9	10	11	12	13	14	15

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TABLE.....(c)

Statement showing the location and other particulars of Livestock Farms in the Province/State.....during the year.....

(c) Goats.

Name and address of farm.	Area of Farm.		Purpose of the herd.	Breed.	Strength of the herd in each breed.		
	Total	Under cultivation			Bucks.	Does.	Kids.
1	2	3	4	5	6	7	8

Number of Bucks issued during :—			Average yield for the Herd.			Remarks.
Year under report.	Last year.	Year before last.	Milk	Days milk	Days dry.	
9	10	11	12	13	14	15

TABLE.....(*d*)

Statement showing the location and other particulars of Livestock Farms in the Province/ State.....during the year.....

(d) Poultry.

Name and address of farm.	Area of the Farm.		Purpose of the farm and flock.	Breed.	Number of birds of each breed on the farm.		
	Total	Under cultivation			Cocks.	Hens.	Chickens.
1	2	3	4	5	6	7	8

Number of cockerells issued for breeding during :—			Number of Hatching eggs sold during			Average annual egg yield per hen.	Remarks.
Year under report	Last year.	Year before last.	Year under report	Last year.	Year before last.		
9	10	11	12	13	14	15	16.

TABLE.....(e)

Statement showing location and other particulars of Livestock Farms in the Province/ State.....during.....

(e) Other Livestock

Name and address of farm.	Area of the farm.		Purpose of the Farm and herd	Breed. and spices.	Number on the farm.	Remarks.
	Total.	Under cultivation.				
1	2	3	4	5	6	7

APPENDIX V.

RESOLUTIONS PASSED AT THE SILVICULTURE CONFERENCE 1946

ITEM 8. PASTURE AND FODDER.

Names of Committee Mumbers.

WHEREAS

(*a*) It has been represented that in several Provinces and States there is no declared policy in respect of Pasture and Fodder.

THIS CONFERENCE RESOLVES THAT

(1) *The attention of the Senior Officers Conference be drawn to the importance of ensuring that policies on this subject are formulated.*

AND WHEREAS

(*b*) The policy of the past two decades has been to limit the powers of control over the grazing animal by forest officers and to reduce or abolish charges made for forest grazing.

(*c*) This policy has led to an excessive concentration of livestock of low quality on grazing grounds which has caused the progressive deterioration of the pastures and has resulted in soil erosion on a significant scale.

(*d*) Great improvement of deteriorated pastures is possible by the correct application of up to date technical knowledge and experience.

THIS CONFERENCE RESOLVES THAT

(2) *The attention of the Senior Officers' Conference be drawn to the fact that extensive measures of pasture improvement are prevented by the failure to implement the resolutions of past conferences on the subject of control of the grazing animal.*

(3) *To prevent the further deterioration of pasture it is essential that the incidence of grazing be limited to the carrying capacity and that, after being grazed, pasture should be given rest to recuperate* e.g. *some form of grazing regulation such as rotational or periodic closures.*

(4) Limitation of grazing incidence must involve the exlusion of exeess livestock. Utility cattle both draught and milch should be given preference of admission to pastures.

(5) Collateral research on problems arising out of the items above should be undertaken.

(6) The attention of the Senior Officers' Conference be drawn to the fact that.

(*i*) Effective limitation is most likely to be achieved by economic pressure aimed at the elimination of animals of least economic value. It is therefore desirable that grazing charges should be reintroduced where already abolished or be enhanced until the demand is reduced to balance production.

(*ii*) The increase of revenues accruing from (*i*) above justifies more expenditure on pasture improvement and provision of grazing facilities. It is therefore desirable that measures to this end should be taken and adequate staff provided for supervision.

AND WHEREAS

(*e*) The fodder problem in many Provinces and States is urgent and cannot be solved immediately by direct methods alone *i.e.* by means of limitation of incidence and regulation of grazing,

THIS CONFERENCE RESOLVES THAT

(7) *Every effort should be made to supplement existing fodder and grazing resources by indirect methods such as introduction of grasses, legumes and fodder trees, and encouragment of haymaking and ensilage,*

AND WHEREAS

(*f*) In all future legislative exactments for the management of private estate forests and waste lands, provision for limitation of incidence and regulation of movement are essential in the intresets of soil conservation, animal husbandry and fodder and grazing resources,

THIS CONFERENCE RESOLVES THAT

(8) The attention of the Senior Officers Conference be drawn to the necessity for such provision,

AND WHEREAS

(*g*) Browsing particularly by goats has caused excessive and incalculable damage to forests and grazing grounds has aggravated soil erosion.

THIS CONFERENCE RESOLVES THAT

(9) *The attention of the Senior Officers' Conference be invited to the desirability of adopting strong measures with a view to the exclusion of goats and other browsers from forests and grazing grounds.*